University Of Alberta
0 0002 08905 54

URRICULUM

QA
107
S42
1974
LEV.3
TCH.GD
. BK.4

s Guide
Book 4

SRA
MATHEMATICS
LEARNING SYSTEM TEXT

Ex libris
universitatis
albertaensis

# Canadian Publication

## MATHEMATICS LEARNING SYSTEM

The Canadian publication of *Mathematics Learning System* is completely metric.

On some pages, major revisions have been made. In several cases the goal of the page has been altered, as indicated below:

Page 238 Developing an intuitive feel for a kilogram
Page 241 Learning about scales weighing in g and kg
Page 242 Selecting an appropriate unit of measure

Substantial revisions have also been made in the pupils' text on pages 233, 234, 235, 236, 239, 240, 241, 242, 243, 252, 258, 259, and 261, and minor ones on several other pages. These include several new photographs, but do not affect the teaching of the program.

On the following pages, the answers are as given below:

On the pages listed below, the answers in the Teacher's Guide are numerically correct for the questions in the pupils' text. However, the questions have been altered to include only metric units.

Page 218 7. The answer now refers to containers, not quarts.
Page 236 2a, c, d. The answers now refer to kilograms, not pounds.

Page 234
kg kg
g kg

Page 236
1a. g
b. kg
c. kg
d. g
e. g
f. kg

Page 239
1b. 2000 g
2a. 300 g
b. 315 g

Page 240
1a. 130 kg
b. 4 marks between 0 and 5
One kilogram
2a. 25 kg
b. 40 kg
c. 60 kg.

Page 241
On the hook scales,
1 kilogram, 250 grams.
On the pan scales,
100 grams, 50 grams.
Bathroom scales cannot be seen.

Page 242
a. kg
b. kg
c. g
d. g
e. kg
f. kg
g. kg
h. g
i. g or kg
j. kg
k. g
l. kg
m. g or kg
n. kg

Page 243
1b. True
2a. 300 g
b. 350 g
c. 85 kg

Page 255
2a. 22°C
b. 24°C
c. 30°C
d. 26°C
e. 26°C
f. 28°C
g. 29°C

Teacher's Guide
Level 3 Book 4

# SRA MATHEMATICS LEARNING SYSTEM TEXT

**M. Vere DeVault**
Professor of Curriculum and Instruction
University of Wisconsin

**Helen Frehmeyer**
Classroom Teacher and
Educational Consultant

**Herbert J. Greenberg**
Chairman, Department of Mathematics
University of Denver

**Stanley J. Bezuszka**
Director
Boston College Mathematics Institute

SRA
SCIENCE RESEARCH ASSOCIATES, INC.
Chicago, Palo Alto, Toronto
Henley-on-Thames, Sydney, Paris
A Subsidiary of IBM

© 1974, Science Research Associates, Inc.
All rights reserved.

Printed in the United States of America

# CONTENTS


## Book 1

**chapter 1**
**+ and − xv**

Notes and things xvi • Survey 2
Examining many names for a number 3
Addition fact practice 4–8
**Progress Check 9**
Adding 3 numbers 10–12
Subtraction fact practice 13–14
**Progress Check 15**
Addition and subtraction fact practice 16
Place value for 2-digit numbers 17
Adding 2-digit numbers—no renaming 18–20
Adding 2-digit numbers—renaming 21–22
**Progress Check 23**
Subtracting 2-digit numbers—no renaming 24–26
**Progress Check 26**
Subtracting 2-digit numbers—renaming 27–31
Checking subtraction by addition 32
**Progress Check 33**
Word problems 34–35
**Checkout 36**
Resource Section 36a–d

**chapter 2**
**multiplication 36e**

Notes and things 36f • Survey 38–39
Skip-counting 40
Readiness for multiplication 41–44
Arrays and multiplication 45–46
Multiplication as an operation 47–49
Examining 0 and 1 as factors 50
**Checkout 51**
Resource Section 51a–b

**chapter 3**
**addition 51c**

Notes and things 51d • Survey 53
Place value for 3-digit numbers 54–56
Renaming and comparing numbers 57–59
Diagnosis of addition skills 60
Short algorithm for addition 61–62, 64
**Progress Check 63**
Adding 3-digit numbers 65–67, 69
**Progress Check 68**
Adding three 2- or 3-digit numbers 70
Addition practice 71
**Checkout 72**
Resource Section 72a–c

## Book 2

**chapter 4**
**geometry—shapes 72g**

Notes and things 72h • Survey 73–74
Identifying flat and cruved surfaces, edges, and vertices 75–76
Exploring plane figures 77–82
**Checkout 83**
Resource Section 83a–b

**chapter 5**
**subtraction 83c**

Notes and things 83d • Survey 85
Identifying subtraction skill 86, 88
Subtracting multiples of 10 87
Subtracting—2-digit number from 3-digit number, no renaming 89–92
1-digit number from 2-digit number with renaming 93–94
two 2-digit numbers with renaming 95–97
2-digit number from 3-digit number with renaming 98–101
2-digit number from 3-digit number, renaming tens and hundreds 102–103
Review of subtraction skills 104–105
Extension pages—applying subtraction 106–107
**Checkout 108**
Resource Section 108a–b

**chapter 6**
**geometry—symmetry 108c**

Notes and things 108d
Using shapes to cover a region 110–112
Testing for square corners 113
Finding lines of symmetry 114–117
Relating symmetry to the real world 118
**Checkout 118**
Resource Section 118a–b

**chapter 7**
**multiplication 118c**

Notes and things 118d • Survey 120
Review of the concept 121
Multiplication fact practice 122–128
Applications 129
**Progress Check 130**
The multiplication algorithm 131–132
Multiplying 2-digit factor by 1-digit factor, no renaming 133–135
**Progress Check 136**
Multiplying 2-digit factor by 1-digit factor with renaming 137–139
**Progress Check 140**
Applications 141
Extension—multiplying by 10 142–143
**Checkout 144**
Resource Section 144a–h


LIBRARY
UNIVERSITY OF ALBERTA

## Book 3


**chapter 8**
**addition and subtraction 144m**

Notes and things 144n • Survey 146
Place value and numeration 147–151
Addition and subtraction facts 152–154
Adding and subtracting—
multiples of 10 155–156
2-digit numbers, no renaming 157–158
2-digit numbers with renaming 159–162
**Progress Check 163, 164**
Adding 3-digit numbers with renaming 165–168
Adding 4-digit numbers with renaming 169
Subtracting 3-digit numbers with renaming 170–172
Checking subtraction 171
Zero in addition and subtraction 172
Addition and subtraction practice 173–174
Applications 175
Finding errors 176
Diagnosis of advanced addition and subtraction skills 177
**Checkout 178**
Resource Section 178a–b

**chapter 9**
**measurement—length 178c**

Notes and things 178d • Survey 180–181
Experiences in measuring 182–188
Finding related measurements 189–194
Measuring rectangles 195
**Checkout 196**
Resource Section 196a–b

**chapter 10**
**fractions 196c**

Notes and things 196d
Relating fractions to situations 197–199
Fractional parts of a region, a set, and on a number line 200–206
Comparing and renaming fractions 207–210
Fraction names for numbers greater than 1 211
Addition with like denominators 212–213
Subtraction with like denominators 214
Word problems 215
**Checkout 216**
Resource Section 216a–f


## Book 4


**chapter 11**
**multiplication and division 216k**

Notes and things 216l
Readiness for division 218–219
Relating multiplication and division 220–224
Concept of division 225–226
Developing division computation 227–229
Applications 230
Remainders in division 231
**Checkout 232**
Resource Section 232a–b

**chapter 12**
**measurement—weight 232c**

Notes and things 232d • Survey 234
Appropriate units of measure 235
Investigating the relationship of size and shape to weight 236–237
Units of measure and scales 238–242
**Checkout 243**
Resource Section 243a–b

**chapter 13**
**graphs and charts 243c**
Notes and things 243d
Ways to show information 245–250
Picture, circle, and line graphs 251–257
Time-zone chart 258
Mileage chart 259
Average weight chart 260–261
Calendar 262
Usefulness of charts and graphs 263
**Checkout 264**
Resource Section 264a–f


## Book 5


**chapter 14**
**measurement 264k**

Notes and things 264l
Survey (time) 266
Practice in telling and recording time 267–268
Applications 269–274
Survey (liquid measure) 275
Applications 276
Finding equivalent measurements 277, 281
Adding like units of measure 278
Practice in measuring 279–280
**Progress Check 282**
Word problems 283
Appropriate units of measure 284
**Checkout 285**
Resource Section 285a–b

**chapter 15**
**computation 285c**

Notes and things 285d
Addition review 287–288
Subtraction review 289–290
Examining the digit 0 291
Concept of estimation 292–293
Estimating sums, differences, and products 294–296
Multiplication review 297–298
Comparing measurements 299
Application of multiplication 300
Relating division to multiplication 301–302
Estimating division answers 303
Exploring the concept of divisibility 304
Division review 305
Extending division skills 306–308
**Checkout 309–312**
Resource Section 312a–h

**other learning aids**
**bibliography**
**glossary**
**index**


2468869

# Notes & Things

Division is the last whole-number operation to be studied. This chapter explores the concept itself—the action of the operation. Understanding the operation is the groundwork for both skill development and attitude toward the skill itself.

Do you remember when you were in elementary school? Didn't it once seem as if there were only two groups of people in the world—those who knew how to divide and those who hated division? The operation probably wouldn't win many popularity contests today either. Maybe your approach and this chapter will start changing things.

The concept of division is a demanding idea. You can get the answer to a division problem in more than one way. Using the idea of repeated subtraction does let an answer evolve. But repeated subtraction is slow and painful. Many people prefer to use the division facts along with knowledge of place value to get the job done. Others prefer to use the idea of finding the missing factor. Any one of these ways is all right, providing the idea is used efficiently.

The chapter briefly explores all three ways. It does introduce the notation of division. It gives some practice with the division facts. But the most important function of the chapter is to encourage a way of thinking about division.

$72 \div 9 = ?$ is a notation form.
$9\overline{)72}$ is another notation form. This one is most frequently used when actual computation is to be done. *How many 9s in 72?* is the question that we think when we are searching for the answer.

That thought question is basic to division, no matter how large or small the numbers are. That thought question is therefore the emphasis of the chapter. It can be answered by knowing the multiplication facts OR the division facts. This book does not dictate how to get the answer, but the child who has mastered the multiplication facts should not have any trouble getting it. If you prefer to emphasize the division facts, that option is yours. The pupil pages are flexible enough to let you present what you consider the best approach.

You may be surprised to see the notion of remainders presented at such an early stage. If division is to be related to the real world and to everyday uses of this operation, remainders must be considered.

Remainders are not always handled the same way in everyday situations. If you are dividing 7 cookies between 2 people, you can split that remaining cookie. But if you are dividing 7 people into 2 teams, handling the remaining person is quite a different situation. Notation for remainders is not presented, but the idea is explored.

## things

counters
multiplication flash cards
division flash cards, aluminum foil trays, and scraps of colored paper are optional

For the extra activities you will want to have available snap clothespins.

**goal** Think about and explore ideas through a picture clue

**page 217** No one will know for sure why that wood is being divided into pieces. What ideas do the youngsters have?

Use this page as you did an earlier one. Take time out to investigate words. Let the youngsters find out how often the word **division** is used in everyday conversation.

What have they had to divide? If there are brothers and sisters in the family, chances are they have had to divide their toys, divide the last piece of cake, divide the jobs, and so on. What happens to the number of toys that person had after they were divided up? What about the size of that piece of cake? What happened to the number of jobs each one had to do?

What about multiplication? What would have happened to a number of toys? a number of pieces of cake? a number of jobs? Can anyone think of other times multiplication or division is involved? One thing every youngster can count on —multiplication and division will certainly be involved in the chapter to come!

**lesson** Pages 218, 219

**goal** Developing readiness for division

**memo** Pages 218 and 219 are related; they should be worked together.

**things** counters

**page 218** There is no one way to solve these problems. Let the pupils use any technique they can think of. Counters or drawings should be encouraged; but give minimal guidance unless you see signs of frustration. Help by suggesting that they think subtraction.

Problem 1 may be solved with subtraction as follows:

$$\begin{array}{rl} 48 & \\ -\ 8 & \text{1 package} \\ \hline 40 & \\ -\ 8 & \text{1 package} \\ \hline 32 & \\ -\ 8 & \text{1 package} \\ \hline 24 & \end{array}$$

Continue until no more hotdogs are left. Add up the number of packages. Do not introduce the division sentence yet—time for that later.

They were planning a picnic. They had to decide how much food to buy.

1. They needed 48 hotdogs.
   Hotdogs came in packages of 8.
   How many packages did they need? 6

2. They needed 48 hotdog buns.
   Buns came in packages of 6.
   How many packages did they need? 8

3. They needed 18 apples.
   Apples were packed in trays of 3.
   How many packages did they need? 6

4. They needed 24 oranges.
   Oranges were packed in trays of 4.
   How many packages did they need? 6

5. They needed 21 big dill pickles.
   Pickles were packed in threes.
   How many packs of 3 did they need? 7

6. They needed 30 lemons for lemonade.
   Lemons were packed in trays of 5.
   How many packages did they need? 6

7. They needed 42 servings of ice cream.
   There were 6 servings in 1 quart.
   How many quarts did they need? 7

8. They also needed catsup and mustard.
   How much do you think they should buy?
   What other food should they buy? Discuss.
   Encourage consideration of other things people might want at a picnic.
   Examples: potato chips, paper cups.

You have been using the idea
of division to get your answers.
Your

GOAL
GOAT

is to learn a lot about division.
But as for now, keep on
planning the picnic.

218

9. Can you figure out how many people they were going to feed?
Why did you decide on that number?
Discuss. Accept answers that show consideration of number of hotdogs and ice-cream servings. (Range: 24 to 48)

10. Do you think they should plan to bring things other than food?

   **a** What about paper plates? How are paper plates packaged? Quantities vary from 10 to 100 in a package.

   **b** What about paper cups? How many packages? Depends on number in package and number of people coming.

   **c** What about plastic forks? Do they come in packages too? Yes

   **d** What about napkins? Would a roll of paper towels work just as well? Which do you think would be cheaper? Possibly napkins in economy-size packages — but th… more than you needed.

**goal** Developing readiness for division

**page 219** Encourage discussion. *Are all your favorite picnic foods on the list? How can the lemonade be kept cold?*

Send the pupils out to become researchers for problem 10. Look out! Packaging is not uniform. Compare the findings.

**lesson** Pages 220, 221, 222, 223, 224

**goal** Developing readiness for division by examining missing factors in multiplication

**things** counters

**page 220** Have the youngsters make an array with 3 rows of 4 counters, then an array with 4 rows of 3. The "How many in all?" does not change. Let them discover that changing the order of the factors can be shown by merely turning the array.

It's been quite a while since the youngsters have worked with multiplication. Review the model for a multiplication sentence presented earlier in this level.

$$3 \times 4 = 12$$

**This factor tells how many rows** — **This factor tells how many in each row.** — **The product tells how many in all.**

Learners who need to make arrays for the problems should be encouraged to do so. Let them use counters or just draw the array on scratch paper.

220

X X X X
X X X X
X X X X

1. This array has 3 rows of 4.
How many in all? $3 \times 4 = \underline{?}$ 12
How many in all if the array had shown 4 rows of 3? $4 \times 3 = \underline{?}$ 12
Both 3 and 4 are factors. Your answer is a product.
The order of the factors does not change the product.

2. You draw an array of 12 objects in all. X X X X X X / X X X X X X (Objects in set may vary.)
Make each row have 6 objects.
How many rows did you show? $\blacksquare \times 6 = 12$ 2 2
Here the product was given. And you know one factor.
You had to find a missing factor.

3. You draw an array of 24 objects in all. (Objects in set may vary.)
Make 8 rows.
How many objects in each row? $8 \times \blacksquare = 24$ 3 3
Again the product was given. And you know one factor.
You had to find a missing factor.

4. Find the missing factors. You can make an array to help if you need to.

| | | | | | |
|---|---|---|---|---|---|
| **a** | $2 \times \blacksquare = 10$ 5 | **b** | $3 \times \blacksquare = 15$ 5 | **c** | $4 \times \blacksquare = 8$ 2 |
| **d** | $3 \times \blacksquare = 9$ 3 | **e** | $5 \times \blacksquare = 5$ 1 | **f** | $2 \times \blacksquare = 18$ 9 |
| **g** | $\blacksquare \times 4 = 16$ 4 | **h** | $\blacksquare \times 7 = 28$ 4 | **i** | $\blacksquare \times 5 = 20$ 4 |
| **j** | $\blacksquare \times 8 = 16$ 2 | **k** | $\blacksquare \times 6 = 18$ 3 | **l** | $\blacksquare \times 7 = 21$ 3 |
| **m** | $5 \times \blacksquare = 25$ 5 | **n** | $\blacksquare \times 3 = 21$ 7 | **o** | $\blacksquare \times 8 = 32$ 4 |
| **p** | $9 \times \blacksquare = 27$ 3 | **q** | $7 \times \blacksquare = 28$ 4 | **r** | $\blacksquare \times 9 = 36$ 4 |

Think about big boxes, little boxes, middle-sized boxes.
Each box has objects inside. You decide what's inside.
Each box has the objects packed in trays.
There is more than one tray in each box.
There are the same number of objects in each tray.
You will know how many there are in all.
You will know how many trays.

## Your job is to find how many in each tray.

**1.** 8 in all.
2 trays.
How many in each tray? $2 \times \underline{?} = 8$ 4

**2.** 10 in all.
5 trays. 2
How many in each tray?
$5 \times \underline{?} = 10$ 2

**3.** 6 in all.
3 trays.
How many in each tray? 2
$3 \times \underline{?} = 6$ 2

**4.** 16 in all.
4 trays. 4
How many in each tray?
$4 \times \underline{?} = 16$ 4

**5.** 15 in all.
3 trays.
How many in each tray? 5
$3 \times \underline{?} = 15$ 5

**6.** 12 in all.
2 trays. 6
How many in each tray?
$2 \times \underline{?} = 12$ 6

**7.** 30 in all.
5 trays.
How many in each tray? 6
$5 \times \underline{?} = 30$ 6

You found a missing factor in each of these problems.



**goal** Practice in finding missing factors in multiplication

**things** aluminum-foil trays (optional)
scraps of colored paper (optional)

**page 221** Most children will probably rely on their skill with multiplication facts to find the missing factors. Those who have difficulty may draw pictures, make arrays, or use manipulative materials.

You may wish to simulate the activity of the page. Use a sheet of paper as the "let's pretend" tray and globs of color to represent the number of objects in each tray—2 trays, 2 sheets of paper; 3 trays, 3 sheets; and so on. If you need something more concrete, consider aluminum-foil trays and scraps of colored paper. They are great!

**goal** Developing the meaning of the word **divide**

**page 222** Pupils who have not yet mastered the multiplication facts will have to rely on drawing pictures or manipulating counters. *As more people share, what happens to the number of cookies each person gets?*

The focus is on **sharing** or **dividing** quantities of cookies. Naturally, everyone wants to receive the same amount.

**1.** There were twelve cookies in the cookie jar.

**a** If two people divided them equally, how many for each? 6

**b** If three people divided them equally, how many for each? 4

**c** If four people divided them equally, how many for each? 3

**d** If six people divided them equally, how many for each? 2

**e** If twelve people divided them equally, how many for each? 1

**f** 10 cookies

| | |
|---|---|
| 2 people | ? each 5 |
| 5 people | ? each 2 |
| 10 people | ? each 1 |

**g** 18 cookies

| | |
|---|---|
| 2 people | ? each 9 |
| 3 people | ? each 6 |
| 6 people | ? each 3 |
| 9 people | ? each 2 |
| 18 people | ? each 1 |

**h** 14 cookies

| | |
|---|---|
| 2 people | ? each 7 |
| 7 people | ? each 2 |
| 14 people | ? each 1 |

**i** (6)

| | |
|---|---|
| 2 | ? 3 |
| 3 | ? 2 |
| 6 | ? 1 |

**j** (16)

| | |
|---|---|
| 2 | ? 8 |
| 4 | ? 4 |
| 8 | ? 2 |
| 16 | ? 1 |

**k** (8)

| | |
|---|---|
| 2 | ? 4 |
| 4 | ? 2 |
| 8 | ? 1 |

**l** (36)

| | |
|---|---|
| 4 | ? 9 |
| 6 | ? 6 |
| 9 | ? 4 |

**m** (9)

| | |
|---|---|
| 3 | ? 3 |
| 9 | ? 1 |

**n** (20)

| | |
|---|---|
| 4 | ? 5 |
| 5 | ? 4 |
| 10 | ? 2 |

The word *divide* has been used many times. You know how to add, subtract, and multiply numbers. There is one more operation on numbers to explore.

Get ready to divide numbers.

222

To find a missing factor, you can use the operation of division.
$3 \times \underline{?} = 15$ could be written $15 \div 3 = \underline{?}$.
The symbol $\div$ is the division sign. $15 \div 3 = \underline{?}$ is read "15 divided by 3 equals what number?"

Division is closely related to multiplication.
If $27 \div 9 = 3$, then it must also be true that $9 \times 3 = 27$. Is that true?

$12 \div 6 = \underline{?}$ since $6 \times \underline{?} = 12$

$15 \div 3 = \underline{?}$ since $3 \times \underline{?} = 15$

**1.** Complete each division sentence.
Use the missing-factor sentence to help you.

**a** $4 \div 2 = \underline{?}$ 2
$2 \times \underline{?} = 4$ 2

**b** $18 \div 3 = \underline{?}$ 6
$3 \times \underline{?} = 18$ 6

**c** $20 \div 4 = \underline{?}$ 5
$4 \times \underline{?} = 20$ 5

**d** $25 \div 5 = \underline{?}$ 5
$5 \times \underline{?} = 25$ 5

**e** $14 \div 7 = \underline{?}$ 2
$7 \times \underline{?} = 14$ 2

**f** $15 \div 5 = \underline{?}$ 3
$5 \times \underline{?} = 15$ 3

**g** $18 \div 9 = \underline{?}$ 2
$9 \times \underline{?} = 18$ 2

**h** $24 \div 8 = \underline{?}$ 3
$8 \times \underline{?} = 24$ 3

**i** $6 \div 2 = \underline{?}$ 3
$2 \times \underline{?} = 6$ 3

**j** $28 \div 7 = \underline{?}$ 4
$7 \times \underline{?} = 28$ 4

**k** $30 \div 6 = \underline{?}$ 5
$6 \times \underline{?} = 30$ 5

**l** $35 \div 7 = \underline{?}$ 5
$7 \times \underline{?} = 35$ 5

**m** $36 \div 6 = \underline{?}$ 6
$6 \times \underline{?} = 36$ 6

**n** $35 \div 5 = \underline{?}$ 7
$5 \times \underline{?} = 35$ 7

**o** $27 \div 9 = \underline{?}$ 3
$9 \times \underline{?} = 27$ 3

223

**things** counters

Hand the youngster the number of counters indicated by the product. Ask him to separate the counters into the number of sets indicated by the known factor. *How many in each set?* Mix the counters. Then ask him to build an array having the number of rows indicated by the known factor. *How many in each row?*

The child who does not know his multiplication facts is in real trouble. He should spend more time working on multiplication before going into division.

**goal** Relating division to the missing factor; introducing the division symbol

**memo** The remainder of this chapter is exploratory. Mastery of division is not expected at this level.

**warm-up** Let the children tell you how much they already know about mathematics. Let them tell you that the "=" symbol shows that 2 quantities are the same. They know the "+" symbol and they know how to add.

Continue with subtraction and multiplication. They know what the words **factor** and **product** mean—even how to find missing factors. Only very smart people can do that job! Your pupils are so-o-o very smart that they really and truly have proved that they know how to DIVIDE. *Have you ever before heard of dividing? Dividing is another operation on numbers. In fact, it is the last operation on whole numbers that you will learn.*

**page 223** Go over the introduction. Express pleasure over your surprise—you didn't know that they knew how to divide.

This page uses the division symbol. The pupils will need some practice writing it; and that practice is given on the next page. The phrase **division sentence** will also be new to them.

Any youngster who experiences trouble should stop working on the page and do the suggested activity instead.

**goal** Relating multiplication and division

**page 224** Challenge only your capable learners to write as many sentences as possible for problems 1 through 8. The sharpie who writes $45 \div ? = 9$ is correct; even $? \div 45 = 9$ cannot be called wrong. Writing the latter sentence would happen only by accident, and the youngster would be hard pressed to find a replacement for the **?**. Ease that pupil back to the division sentence that will tell how many 9s in 45.

Youngsters who can write the division sentences should have no trouble finishing the page. Do praise those who can write these sentences, even though they may still have troubles in replacing the **?** with a number. These pupils have shown that they understand the relationship between multiplication and division. Great! Mastery of division facts will come with more practice. Encourage them to use either the multiplication facts or counters to help find troublesome answers.

Here are some symbols that are all mixed up. Can you rearrange them so that they make a multiplication or a division sentence? Sentences may vary. Accept other good answers.

1. $36 \times ? = 6$
   $6 \times ? = 36$
   6
2. $45 \div 9 = ?$
   5
3. $14 \div 2 = ?$
   7
4. $56 \div 8 = ?$
   7
5. $9 \times ? = 72$
   8
6. $36 \div 9 = ?$
   4
7. $6 \times 9 = ?$
   54
8. $7 \times 9 = ?$
   63

9. Go back and find a number that can replace the **?** and make each sentence true.

10. Write each of these missing-factor sentences as a division sentence.

   **a** $5 \times ? = 15$
   $15 \div 5 = ?, 3$

   **b** $? \times 5 = 10$
   $10 \div 5 = ?, 2$

   **c** $? \times 3 = 27$
   $27 \div 3 = ?, 9$

   **d** $9 \times ? = 81$
   $81 \div ? = 9, 9$

   **e** $4 \times ? = 4$
   $4 \div 4 = ?, 1$

   **f** $? \times 5 = 45$
   $45 \div ? = 5, 9$

   **g** Replace each ? with a number to make the division sentence true.

224




See activity 1, page 232a.

**1. Count by 2s to 18.**

2 , 4 , 6 , 8 , 10 , 12 , 14 , 16 , 18

a How many 2s to make this number? 5

b How many 2s to make this number? 4

c How many 2s to make this number? 3

**2. Count by 3s to 27.**

3 , 6 , 9 , 12 , 15 , 18 , 21 , 24 , 27

a How many 3s in this number? 6

b How many 3s in this number? 7

c How many 3s in this number? 9

**3. Count by 4s to 36.**

4 , 8 , 12 , 16 , 20 , 24 , 28 , 32 , 36

a How many 4s in ? 6

b How many 4s in ? 8

c How many 4s in ? 9

**4. Count by 5s to 45.**

5 , 10 , 15 , 20 , 25 , 30 , 35 , 40 , 45

a How many 5s in ? 6

b How many 5s in ? 8

c How many 5s in ? 9

225

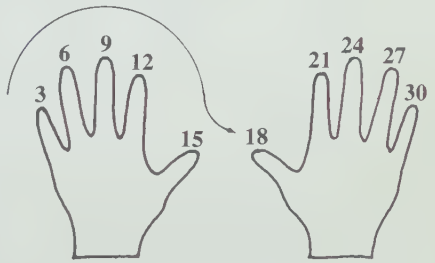
**lesson** Pages 225, 226

**goal** Relating skip-counting to division

**memo** The two pages of this lesson provide another way to look at division. The division notation is not used, but we are only a step away. **How many 7s in 56,** for example, leads directly into the notation $7\overline{)56}$. This notation is used for computation in this chapter.

**page 225** You will want the youngsters to jot down their counting patterns on paper. Check to make sure that these are correct before discussing the questions.

Here is an opportunity for more group practice in skip-counting. You may wish to have them hold up a finger for each product. This will begin to give the youngsters a system for telling how many 3s in 18, for example. Simply look—how many fingers up when 18 is named, counting by 3s? (6)



**goal** Developing the concept of division

**page 226** The numbers in the columns may or may not look like the rows of numbers that the pupils just wrote on page 225. Better not make any assumptions. Start with problem 1. *What do you add to 0 to get 6? to 6 to get 12? to 12 to get 18?* For problem 2, simply ask what number to count by.

The last set of problems checks ability with division facts **and** understanding of the division concept as well.

You will soon know which youngsters need more help. Make sure that they always have a box of counters to use. It's better to provide a substitute security blanket than to let anyone meet with failure.

Somebody has arranged columns of numbers.
They left a note and said each number was in its place for a reason. Figure out how the numbers are related to one another. Then complete each column.

**1**

| |
|---|
| 0 |
| 6 |
| 12 |
| 18 |
| 24 |
| 30 |
| 36 |
| **a** 42 |
| **b** 48 |
| **c** 54 |

**2**

| |
|---|
| 0 |
| 7 |
| 14 |
| 21 |
| 28 |
| 35 |
| **a** 42 |
| **b** 49 |
| **c** 56 |
| **d** 63 |

**3**

| |
|---|
| 0 |
| 8 |
| 16 |
| 24 |
| 32 |
| **a** 40 |
| **b** 48 |
| **c** 56 |
| **d** 64 |
| **e** 72 |

**4**

| |
|---|
| 0 |
| 9 |
| 18 |
| 27 |
| **a** 36 |
| **b** 45 |
| **c** 54 |
| **d** 63 |
| **e** 72 |
| **f** 81 |

**5** Your completed columns above can help you with these problems.

| | | |
|---|---|---|
| **a** How many 7s in 7? 1 | **b** How many 9s in 18? 2 | **c** How many 9s in 45? 5 |
| **d** How many 7s in 42? 6 | **e** How many 8s in 40? 5 | **f** How many 6s in 48? 8 |
| **g** How many 8s in 56? 7 | **h** How many 6s in 54? 9 | **i** How many 7s in 56? 8 |
| **j** How many 8s in 64? 8 | **k** How many 9s in 63? 7 | **l** How many 8s in 72? 9 |

226

There were 12 boxes for Jay to carry.
He took 2 boxes at a time.
How many trips did he make?

**Think** How many 2s in 12?

Does $2 \times 2 = 12$? NO!
$3 \times 2 = 12$? NO!
$4 \times 2 = 12$? NO!
$5 \times 2 = 12$? NO!
$6 \times 2 = 12$? YES!

Check your thinking.
Make sure there are 6 sets of 2 in 12.

1. Jim has 12 boxes to move also.
He took 3 at a time.
How many trips did he have to make?

**Think** How many 3s in 12? 4

2. Big Bill was really strong.
He moved his 12 boxes 4 at a time.
How many trips did he make?

**Think** How many 4s in 12? 3

3. Tiny Tim wasn't so strong. But he was smart.
He got a wagon. The wagon held 6.
How many trips did he make to move the 12 boxes?

**Think** How many 6s in 12? 2



**lesson** Pages 227, 228, 229

**goal** Developing a thought pattern useful in division computation

**page 227** You will want to work together as a group to develop this pattern of thinking. There should be no trouble; the pattern is developed right on the pupil page. Only even division is being considered. The children are encouraged to work with their knowledge of multiplication.

These problems lend themselves well to dramatization. Use books rather than boxes. Have an actor subtract sets of 2 (the divisor in the first example) until none remain. Then count how many sets have been moved.

**goal** Developing skill in estimating answers in division

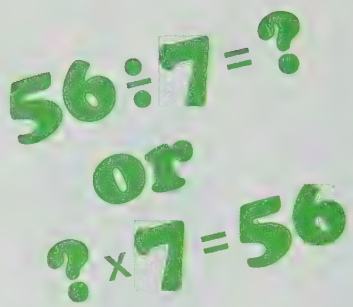
**memo** The pattern of thinking developed on this page will help the learner now and will serve as his foundation for all future work with division.

**page 228** Your guidance is needed on this page. Reading difficulty shouldn't get in the way of **thinking.** Accept oral answers.

Note that the algorithm for division is introduced in 3. Remind the children that they can write an addition sentence as 25 + 15; but when they compute, they usually write it as:

$$\begin{array}{r} 25 \\ +15 \\ \hline \end{array}$$

The same is true for both subtraction and multiplication. Division can also be written $72 \div 9$ and $9\overline{)72}$. Both forms mean the same thing; but when we compute, we usually use the form $9\overline{)72}$.




If you run into trouble, you can try another way.
Ask yourself, How many 7s in 56?
Try some good guessing.

There are more than 5, because $5 \times 7 = 35$
There are more than 6, because $6 \times 7 = 42$
There are more than 7, because $7 \times 7 = 49$
Are there 8? Yes $8 \times 7 = 56$

There is nothing wrong with making a good guess and then checking. In fact, the "good guess–check" idea is a very good way to solve lots of problems.

**1.** $63 \div 9 = \underline{?}$ If you don't know, think, How many 9s in 63?
There are more than 5. Right? Why? Yes $5 \times 9 = 45$
Are there more than 6? Why? Yes $6 \times 9 = 54$
Are there more than 7? Why? No $7 \times 9 = 63$
How many 9s in 63? 7

**2.** $54 \div 6 = \underline{?}$ If you don't know, think, How many 6s in 54?
More than 6? Why? Yes $6 \times 6 = 36$
More than 7? Why? Yes $7 \times 6 = 42$
More than 8? Why? Yes $8 \times 6 = 48$
More than 9? Why? No $9 \times 6 = 54$
How many 6s in 54? 9

**3.** When some people use this idea, they like to write the division sentence in a computation form. They write $9\overline{)72}$ rather than $72 \div 9$.
This form makes it easier to think, How many 9s in 72?
Where could you put the answer? Above the 72

228

$72 \div 9 = \underline{?}$ or $9\overline{)72}$ ← That's the place for your answer to how many 9s in 72.

Are there more than 5? Why? Yes $5 \times 9 = 45$

Are there more than 6? Why? Yes $6 \times 9 = 54$

More than 7? Why? Yes $7 \times 9 = 63$

More than 8? Why? No $8 \times 9 = 72$

You might have had a better guess to start with than 5.
You can start anywhere. You will know if you made a bad guess.

$27 \div 9 = \underline{?}$ or $9\overline{)27}^{3}$ How many 9s in 27?

More than 5? Oooops! No

What happened? Your guess was not a good one; $5 \cdot 9 = 45$

This is how you will know a bad guess.

You know how the game is played. Complete these division problems.
Don't forget to put the answer in the right place.

| | a | b | c | d | e | f |
|---|---|---|---|---|---|---|
| 1. | $7\overline{)49}^{7}$ | $6\overline{)48}^{8}$ | $7\overline{)63}^{9}$ | $9\overline{)81}^{9}$ | $6\overline{)42}^{7}$ | $8\overline{)72}^{9}$ |
| 2. | $8\overline{)64}^{8}$ | $5\overline{)35}^{7}$ | $4\overline{)28}^{7}$ | $4\overline{)36}^{9}$ | $3\overline{)24}^{8}$ | $9\overline{)63}^{7}$ |
| 3. | $5\overline{)45}^{9}$ | $7\overline{)42}^{6}$ | $5\overline{)40}^{8}$ | $7\overline{)35}^{5}$ | $9\overline{)54}^{6}$ | $6\overline{)54}^{9}$ |

Were you a winner?

229

**goal** Practice with division facts, using the computational form

**page 229** Those examples at the top of the page are important. The thinking pattern should be consistently reviewed.

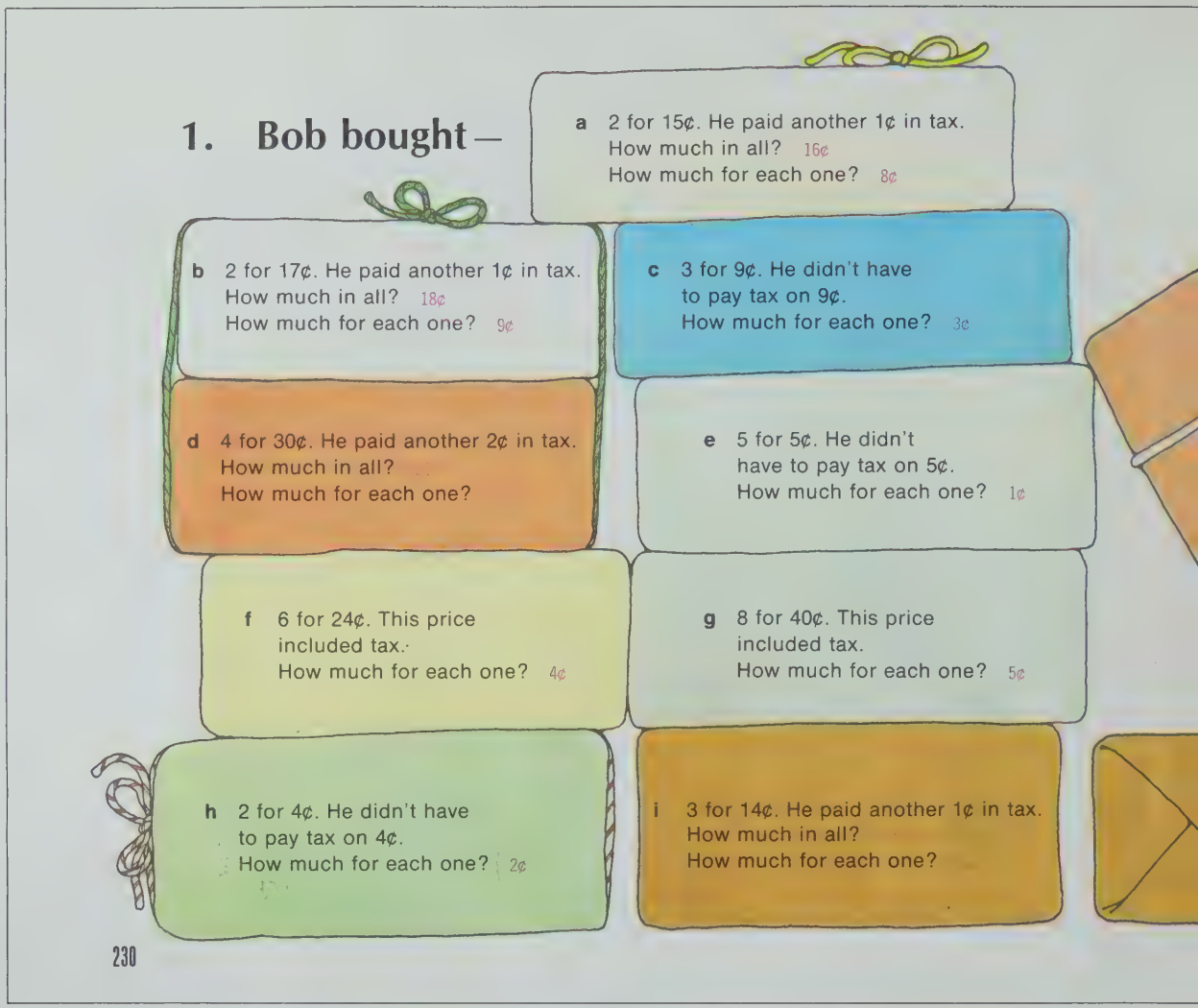
**lesson** Pages 230, 231

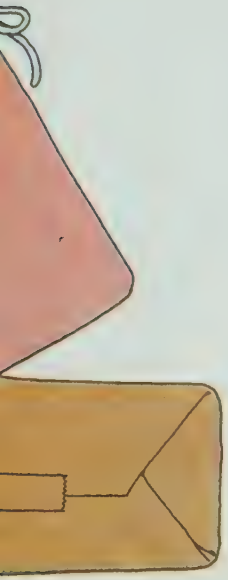
**goal** Application of division

**memo** Does everyone know about a sales tax? You may want to talk about it before starting the page.

**page 230** Emphasize that the tax (where indicated) must be added to the price **before** dividing. For these specific examples, the youngsters must work with two operations—addition followed by division—in the same problem.

Let the abilities of your pupils determine how best to handle this page. The problems aren't really hard.


1. Bob bought—
a 2 for 15¢. He paid another 1¢ in tax.
How much in all? 16¢
How much for each one? 8¢
b 2 for 17¢. He paid another 1¢ in tax.
How much in all? 18¢
How much for each one? 9¢
c 3 for 9¢. He didn't have to pay tax on 9¢.
How much for each one? 3¢
d 4 for 30¢. He paid another 2¢ in tax.
How much in all?
How much for each one?
e 5 for 5¢. He didn't have to pay tax on 5¢.
How much for each one? 1¢
f 6 for 24¢. This price included tax.
How much for each one? 4¢
g 8 for 40¢. This price included tax.
How much for each one? 5¢
h 2 for 4¢. He didn't have to pay tax on 4¢.
How much for each one? 2¢
i 3 for 14¢. He paid another 1¢ in tax.
How much in all?
How much for each one?
230



1. There are times when we divide real objects that the division doesn't come out even. Something remains. We have to decide what to do with the things that remain. Discuss. Encourage alternatives backed by reason(s). Examples are shown.

   **a** There were 7 cookies. 2 people got 3 each.
   1 cookie remains. What can you do with it? Eat it real fast and pretend there were only 6. Or divide it in half.

   **b** There are 3 sticks of gum. 2 people got 1 each.
   1 stick remains. What can you do with it? Put it in your back pocket and save it until you're alone. Or divide it in half.

   **c** There are 25 people. 8 people got on 3 teams.
   1 person remains. What can you do with him? Let him referee, or be a substitute, a scorekeeper, a manager, and so on.

   **d** There are 14 marbles. 4 people get 3 each.
   2 marbles remain. What do you do with them? Play a winner-take-all game, or draw straws for them.

   **e** There is 1 book. Two people want it.
   What can you do about this? Share it. Find another book you want. Don't read—watch TV instead.

2. Switch your thinking cap a little bit. Here are situations that also deal with division that doesn't come out even.

   **a** There are 28 people who are going.
   6 people can go in one car.
   How many cars are needed? 5

   **b** There are 22 things to be boxed.
   4 things fit in each box.
   How many boxes are needed? 6



**goal** Examining remainders in division

**page 231** Some remainders can be divided into fractional parts (cookies, gum), others cannot (marbles, people, books). When fractional parts are possible, everything can be divided equally. When fractional parts are **not** possible, the remainder cannot be divided equally.

Examine the situations for problem 2. Eventually the youngsters will decide that 5 cars are necessary. *Will the fifth car be full? For how many more people is there still room?* Use similar questioning for the last situation.

**lesson** Page 232

**goal** **Checkout**—using the concept of division

**memo** By now you probably know each pupil's ability with multiplication facts and how much more practice is needed. The alternate Checkout in the Resource Section, page 232a, checks both multiplication and division.

**page 232** Get them started. *When the people march 2 in a row, will each row have the same number of people?* Encourage the youngsters to draw an array if they need help in answering the questions. But have them work independently.

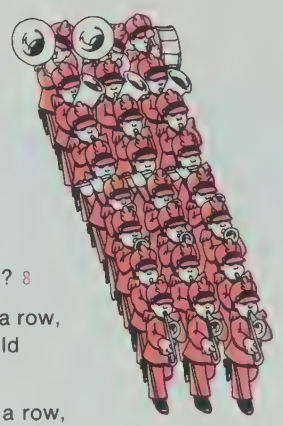
Youngsters who do not know the multiplication facts simply need more practice. Use any trick you have up your sleeve to help. Remember the Resource Section. By all means, enlist the help of the child's parents at this point.

Don't worry about lack of division skill right now. This chapter was an introduction. The kids will have another chance—lots more of them, in fact.

232

## CHECKOUT

Skill: Division facts



1. There were 24 people in the band.
   - **a** If they marched 2 in a row, how many rows would there be? 12
   - **b** If they marched 3 in a row, how many rows would there be? 8
   - **c** If they marched 4 in a row, how many rows would there be? 6
   - **d** If they marched 5 in a row, how many rows would there be? 4, rows of 5, 1 row of 4
   - **e** If they marched 6 in a row, how many rows would there be? 4
   - **f** If they marched 7 in a row, how many rows would there be? 3 rows of 7, 1 row of 3
   - **g** If they marched 8 in a row, how many rows would there be? 3
   - **h** If they marched 24 in a row, how many rows would there be? 1

See activities 2 and 3, page 232a.

How many situations in which people have to multiply or divide can the pupils find? Consider starting a small bulletin board titled "It's time to compute." One child might bring simply a picture of a store, another a notice of a sale at local stores. That's great! They are thinking about real-world applications.

# RESOURCES

## another form of evaluation

**for Checkout**—page 232

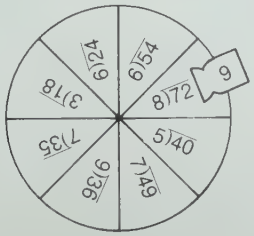
36 people signed up for summer day camp.

a) How many teams of 9 are there? 4
b) How many teams of 6 are there? 6
c) They swim with a buddy. How many pairs (2) are there? 18
d) Each art table has room for 4. How many tables are needed? 9
e) Each lunch table seats 8. How many tables are needed? 4 tables of 8, 1 table of 4
f) Only 12 at a time can work on crafts. How many groups will there be? 3
g) 3 can go in a boat at one time. How many boats are needed? 12
h) Groups of 5 can go on nature walks. How many groups? 7 groups of 5, 1 group of 1

## activities

**1. things** cardboard circular regions, felt pen, snap clothespins

Pizza boards are great for this activity. Divide each region into eights (45° angles). Write a division fact inside each section. Write a numeral, 1 through 9, on each clothespin. The youngster simply clips the answer clothespin to form the equation.




**2. things** division fact cards (no answers visible), numeral cards 0 through 9

Pair pupils who need to practice the same or similar division facts. Select and match 12 facts and 12 appropriate numeral cards to serve as answer cards. Keep the sets of cards separated. The cards are placed facedown on the table and arranged in rectangular arrays—one array containing the fact cards, the other array containing the answer cards.

Players alternate in selecting a card from each array, turning the cards faceup, and deciding whether or not the answer matches the problem. If the cards match, they are removed and held by the player. If the cards do not match, they are turned facedown again and remain in play. The player with the most cards after all the cards have been matched wins.

**3. things** division fact cards (no answers visible), small box, markers

Help pupils fold a piece into 9 spaces to form a 3-by-3 grid. Have them write the numbers 1 through 9 in random order in the 9 spaces. The cards are mixed in the small box.

One pupil serves as caller, drawing a fact card from the box and reading it. If the quotient appears on their sheet, the players cover it with some sort of marker. A row across, a column down, or a diagonal covered wins the game. Drawn cards are not returned to the box; they can be used to verify covered answers in case of a dispute.

## additional learning aids

**operation**—chapter objectives 1, 2

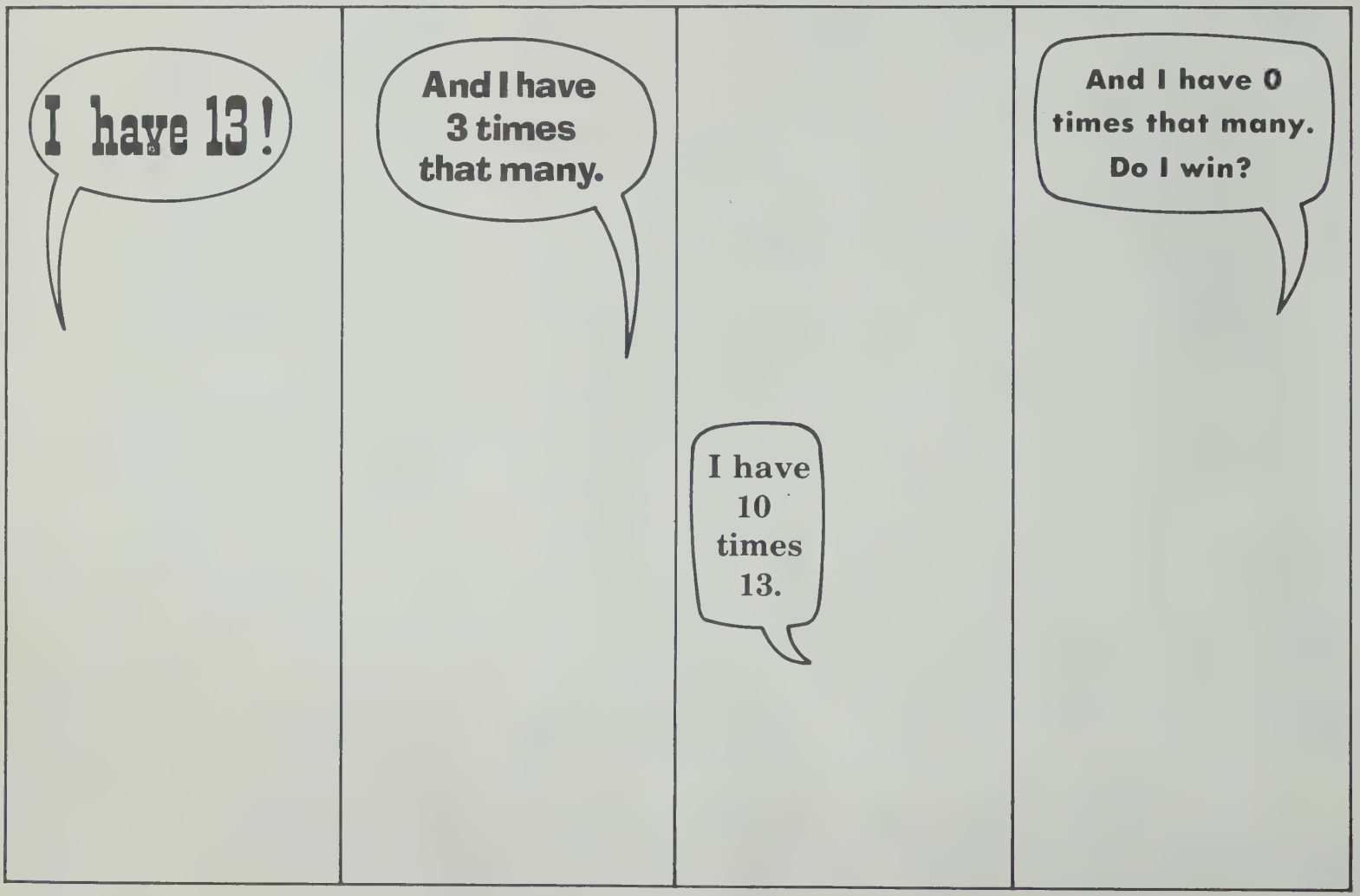
**SRA products**

*Arithmetic Fact Kit*, SRA (1969)
Multiplication cards: 26–29
*Computapes*, SRA (1972)
Module 3, Lessons: MD 6, 7, 8, 15, 16
*diagnosis: an instructional aid—Mathematics Level A*, SRA (1973)
Probe: L-13
*Mathematics Involvement Program*, SRA (1971)
Cards: 153, 34, 144, 225
*Skill through Patterns, level 3*, SRA (1974)
Spirit masters: 33, 42, 43, 44
*Visual Approach to Mathematics, level 3*, SRA (1967)
Visuals: 13, 22

**other learning aids** (described on page 264g)—Cuisenaire rods, I Win (sets 2 and 3), Multifax & Quotient, Quizmo (multiply-divide), Unifix Mathematics Classroom Kit

name _____

## What is this all about? Draw a comic strip.





© 1974, SRA. Permission to reproduce for school use.

# 12 MEASUREMENT WEIGHT

**before this chapter the learner has—**

Measured lengths

**in chapter 12 the learner is—**

1. Selecting an appropriate metric or customary unit of measure to quantify a weight
2. Reading a scale that measures weight
3. Learning about abbreviations for units of measure

**in later chapters the learner will—**

1. Demonstrate ability to select an appropriate metric or customary unit of measure to quantify a weight
2. Explore measuring capacity

# Notes & Things

This measurement chapter on weight (mass) has parallel treatment of the metric system and the customary system of measure. There will be no converting from one system to another, but the selection of an appropriate unit of weight from either system will be featured.

Our world today places a new emphasis on weight measurement. As consumers, everyone is encouraged to read labels. With rising postal rates, there is a greater awareness of very light weight. The emphasis on the slim, trim figure has brought the bathroom scale into greater use, and some diets require that all food be weighed too. Weight plays a role in many everyday situations.

Lifting an object will not tell its actual weight. Reading the dial of a weight scale does not ensure that we know the actual weight of an object either—the scale may not be operating properly. But it is possible to *estimate* weight by lifting an object, if you have had lots of practice in that sort of thing. And a postal scale showing ounces will certainly tell more about the weight of a letter than a bathroom scale. Ideas of this kind are presented in the chapter. There are many ideas to discuss, many activities to do, and lots of things to learn.

It is hoped that each child will become acquainted with the metric units of weight (mass) and start to see some of the advantages of the metric measures. Each child should have enough hands-on experiences to be able to estimate whether something is closer to 1 kilogram or 2 kilograms in weight. And each child may not only become more aware of weight measurements in the everyday world. He may also develop what can be called a "common sense" about weight in general.

Fair warning! Sooner or later you will be faced with a label from a can or package that has a decimal fraction shown. Simply explain that this notation is another way to write a fraction. Don't get in the middle of trying to explain that 1.5 kilograms is the same as $1\frac{1}{2}$ kilograms. Rather, state orally that 1.5 is read "one and five-tenths." Tenths were not featured in the fractions chapter, but it should not be difficult for a child to extend his knowledge to include them.

The notation "$1\frac{1}{2}$ kilograms" should be a no-no. Common fractions really don't belong with the metric system—decimal fractions do. 1.5, 1.50, or 1.500 are all acceptable notations for the same approximate weight, however.

If a label is marked 2.265 kilograms, you will know that it came from a 5-pound package. Once again, read the weight orally as a decimal fraction. The children will learn about decimals and more about metric measures at later levels. You are getting them off to a good start, even if you can't present the whole story.

## things

empty food containers
objects that weight less than, more than, and about 1 pound
bathroom scale, if available
5 quarters
paper clips

**goal** Think about and explore ideas through a picture clue

**page 233** Scales, scales, and more scales! There is so much variety here that you won't have to worry about how to start a discussion but rather how to end it.

Why not have another independent search started. What things are weighed? Why are they weighed? A list, a scrapbook of pictures, or a collection of labels would each be appropriate.

**lesson** Pages 234, 235

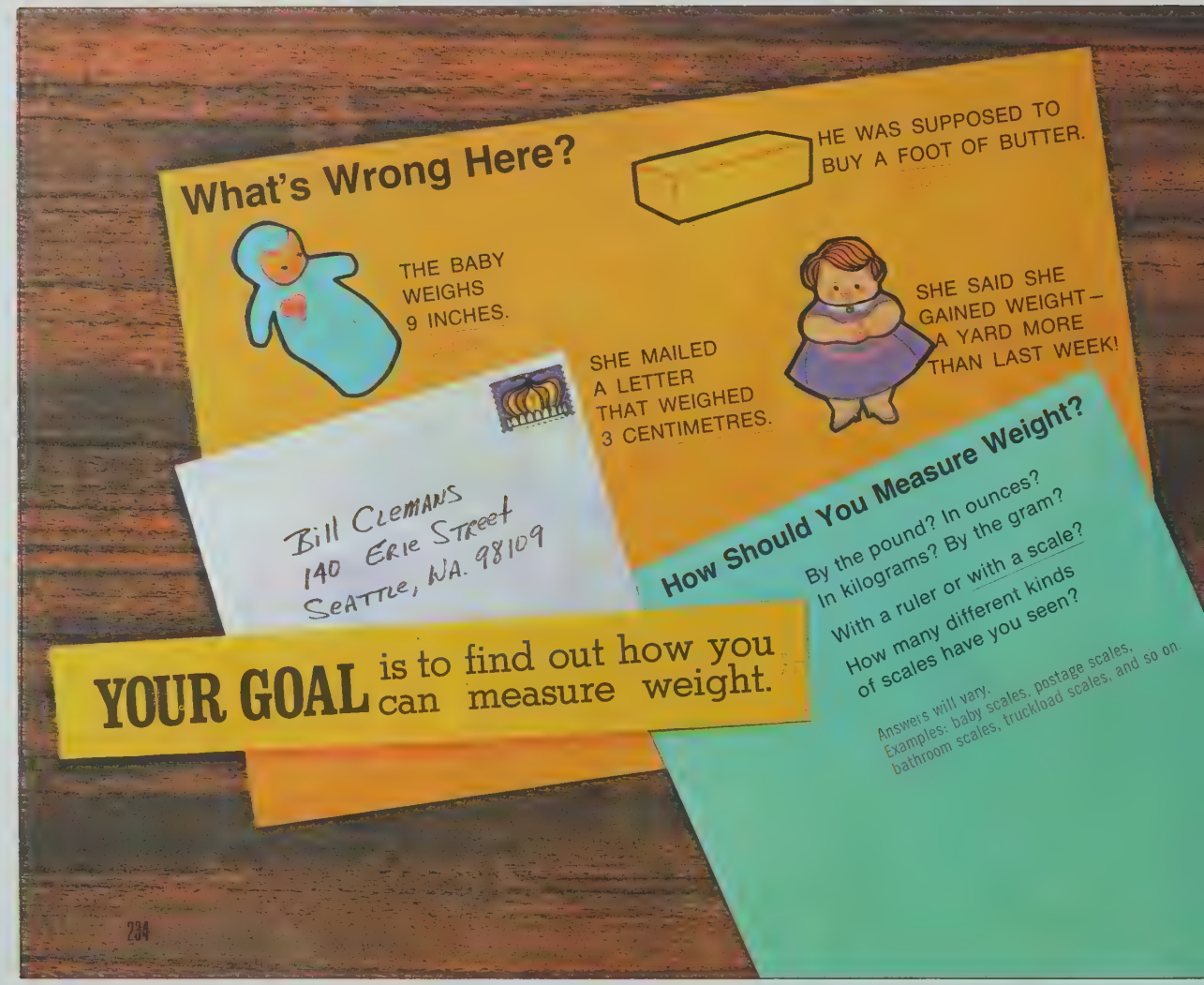
**goal** **Survey**—appropriate units of weight measure and length measure

**page 234** Two types of measure have been jumbled—dry weight and length. Each pupil's reaction to the comments on the page will depend upon previous experience. The page serves as an inventory. Do the youngsters realize the obvious errors?

Ask pupils if they can name an object that could be weighed with each unit of measure named on the page. Are their answers wild guesses, or do they really know?

*What could you measure with a ruler? with a scale?*

*Why so many types of scales? Can you describe or find pictures of other types? Why are some scales more appropriate than others?*


What's Wrong Here?
THE BABY WEIGHS 9 INCHES.
HE WAS SUPPOSED TO BUY A FOOT OF BUTTER.
SHE MAILED A LETTER THAT WEIGHED 3 CENTIMETRES.
SHE SAID SHE GAINED WEIGHT—A YARD MORE THAN LAST WEEK!
Bill Clemans
140 Erie Street
Seattle, WA. 98109
How Should You Measure Weight?
By the pound? In ounces?
In kilograms? By the gram?
With a ruler or with a scale?
How many different kinds of scales have you seen?
Answers will vary.
Examples: baby scales, postage scales, bathroom scales, truckload scales, and so on.
YOUR GOAL is to find out how you can measure weight.
234

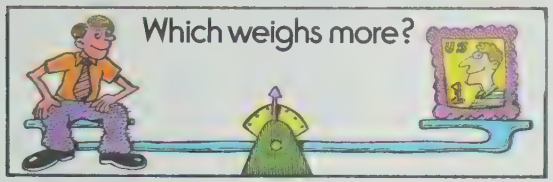
There are two different systems of measure that people use.

Hospitals, scientists, military people, and just about everybody in other countries use METRIC weights.

The metric measure *gram* is used for light objects.

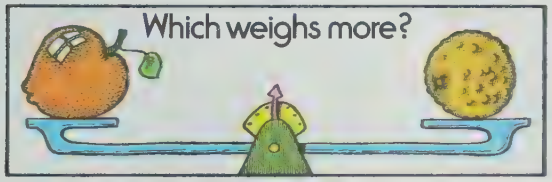
*Kilogram* is the metric measure used for heavier objects.

But in some places things are weighed in *ounces* and *pounds*. An ounce is the unit of measure for light objects. A pound is the unit for heavier things.




1. A man or a postage stamp
   - **a** What unit of metric weight would be used to describe a man's weight? kilogram
   - **b** What unit of metric weight would be used to describe a postage stamp? gram

2. A spoonful of sugar or a full bag of sugar
   - **a** What metric measure would be used to describe the weight of a spoonful of sugar? gram
   - **b** What metric measure would describe the full bag of sugar? kilogram




3. An apple or an orange It would depend on the particular apple or orange
   - **a** What metric measure might be used to describe the weight of either one? gram

235

**goal** Selecting an appropriate unit of weight measure

**page 235** No matter which system of measure is being used, the unit of measure must be appropriate for the item being measured. Why not look back to the pictures of the weight scales on page 233? What scale would be used to weigh a man? a stamp? a spoonful of sugar? a bag of sugar? and so on.

**lesson** Pages 236, 237

**goal** Investigating whether there is a relationship of size and shape to weight

**memo** Abbreviations will pop up when your pupils start looking at packages of food. Pick a corner of the chalkboard and take time to introduce and post the abbreviations for pound (lb.), ounce (oz.), kilogram (kg), and gram (g). Please note —no periods after metric symbols. Add other abbreviations as they turn up on labels or in advertisements.

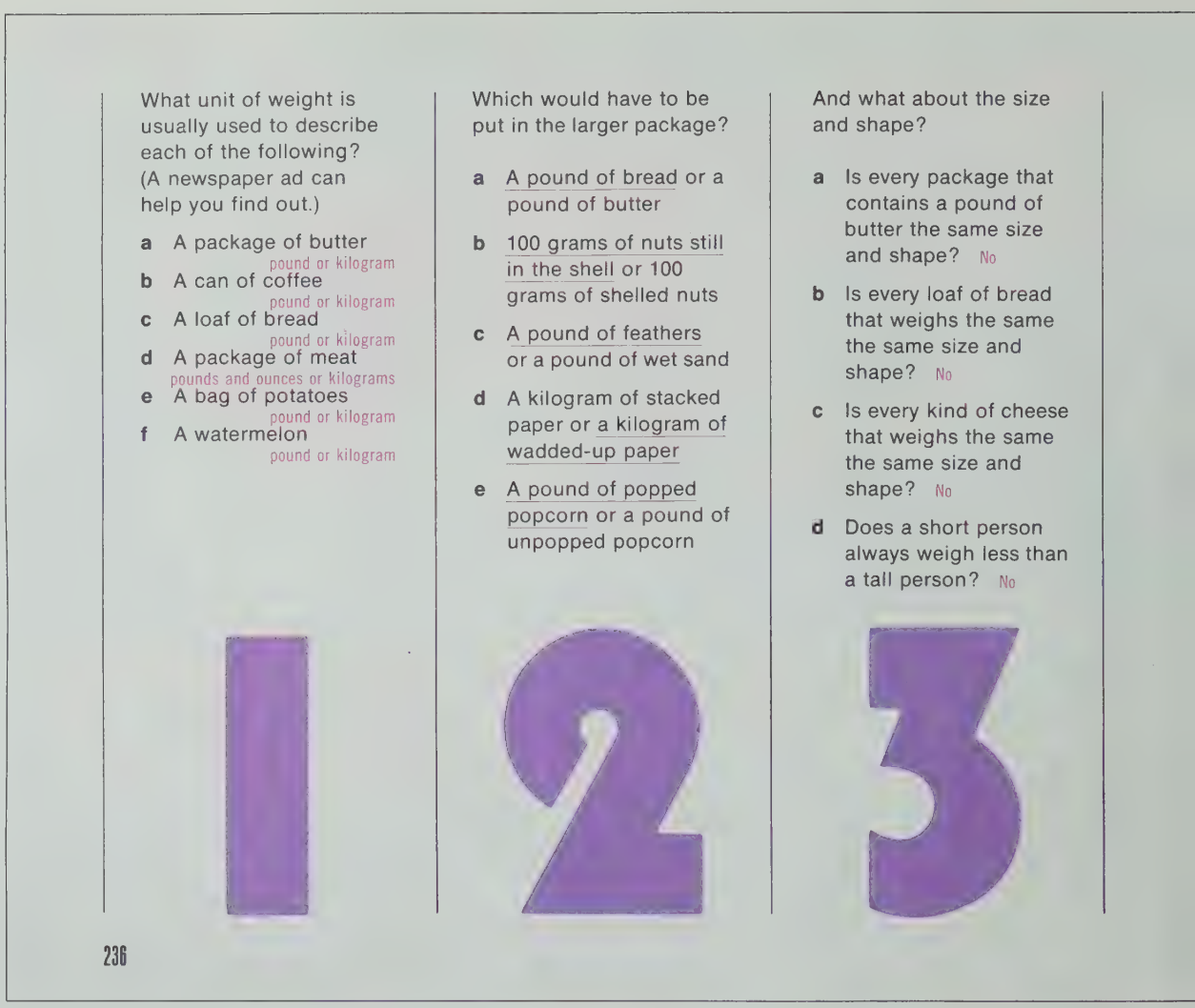
**things** empty food containers

**page 236** Send pupils on an "information hunt." Let them get acquainted with units that are used to measure certain standard food items. These youngsters will learn more from such a research project than from merely being told.

Watch out for labels that have pound weight given with a decimal fraction. For example, 1.4 lbs. (1 and 4 tenths pounds).

Size is not an indication of weight. Be careful on **2a.** Specialty breads, thin-sliced pumpernickel for example, may compare closely in size with a pound of butter. A collection of empty butter, cheese, and similar food cartons with marked weights will prove helpful in considering whether the shape and size of the package are related to weight.

How impressive to compare 2 pounds of popcorn before and after popping! (And then to eat the popped corn, of course.)



What unit of weight is usually used to describe each of the following? (A newspaper ad can help you find out.)

**a** A package of butter
pound or kilogram

**b** A can of coffee
pound or kilogram

**c** A loaf of bread
pound or kilogram

**d** A package of meat
pounds and ounces or kilograms

**e** A bag of potatoes
pound or kilogram

**f** A watermelon
pound or kilogram

Which would have to be put in the larger package?

**a** A pound of bread or a pound of butter

**b** 100 grams of nuts still in the shell or 100 grams of shelled nuts

**c** A pound of feathers or a pound of wet sand

**d** A kilogram of stacked paper or a kilogram of wadded-up paper

**e** A pound of popped popcorn or a pound of unpopped popcorn

And what about the size and shape?

**a** Is every package that contains a pound of butter the same size and shape? No

**b** Is every loaf of bread that weighs the same the same size and shape? No

**c** Is every kind of cheese that weighs the same the same size and shape? No

**d** Does a short person always weigh less than a tall person? No

1 2 3

236

How much do you weigh?

# Find out, please

If you know your weight, report it on the chalkboard.

Problems 1–5: Answers will vary with each group.

1. How many people reported their weight?

2. Arrange the weights in order from least to most.

(Please be gentle if there is an extremely overweight or underweight child in the group. Questions 6, 7, and 8 may help touchy situations.)

3. Do two or more people weigh about the same?

4. Is the tallest person the heaviest?

5. Is the shortest person the lightest?

(It's sometimes awful to be the tallest or shortest too.)

## TALK ABOUT THESE.

6. Will everyone weigh the same a year from now? No

7. Do you know if the person who weighs the least now will weigh the least next year? No

8. Do you know if the tallest person now will be the tallest person one year from now? No

9. Are all people the same age the same weight? No

10. Are all people the same height the same weight? No

11. Have you heard of someone having a small frame or a large frame? What does that mean? Could it make a difference in what a person weighs? Yes

Bone size in comparison to height



**goal** Investigating whether size and shape are related to body weight

**page 237** This page is strictly for investigation and sharing ideas. Size and shape as related to body weight may prove deceptive. Should the tallest youngster be the heaviest or the shortest be the lightest? Is this always true? Will it be true a year from now? What could affect it?

This page can provide a special challenge in sensitivity if you have an extremely overweight or underweight child in the classroom.

**lesson** Pages 238, 239, 240

**goal** Developing an intuitive feel for a pound

**things** objects that weigh 1 lb.
objects that weigh less than and more than 1 lb.

**page 238** There is too much reading for most pupils to do independently, so talk through this page. The learner can develop a feel for a pound by balancing similar weights in each hand. Contrast this with unequal weights and then go back to similar weights. We often estimate the weight of a package in the real world by the "feel" method. Sometimes a scale is necessary to find the exact weight; but many times it is possible to make a good estimate. Consider the weight of a suitcase to be flown overseas or the weight of a package to be mailed at the post office. Is the package within limits? Developing a sense of weight requires a great deal of practice. It will not be accomplished in a day.

The activity adapts to independent work or small-group project. You may want to prepare a spirit master giving the column headings.

You have talked about — grams and kilograms
ounces and pounds
BUT do you really know what these weights feel like?

1. You can't feel how much you weigh, because you can't pick yourself up. Besides that, that's too much weight for you to lift. You can pick up 1 pound or 1 kilogram and feel the weight.

   **a** Find something that weighs about one pound. Find a can of coffee or a package of sugar— anything that weighs 1 pound. (You might see *pound* written as "lb." That's a funny way to write the abbreviation, isn't it?)

   **b** Put the pound weight in your left hand. Now pick up something else in your right hand. Does it weigh about the same? Switch the pound weight to your right hand to test and make sure the two weights feel about the same. Try something else.

2. Make a chart of your tests. Write the names of the objects you lifted. Are they about the same, more than, or less than 1 pound?

| Name of object lifted | Weighs about 1 pound | Weighs more than 1 pound | Weighs less than 1 pound |
|---|---|---|---|
| plant | | ✓ | |

238

Charts will vary with choice of objects and perception of weight comparisons. Watch for obvious errors.

A scale "feels" the weight of objects too. Some scales have a kind of number line showing and a pointer.
Sometimes the number line moves.
Sometimes the pointer moves.

1. Here is an old-fashioned scale used in some grocery stores. It records pounds.

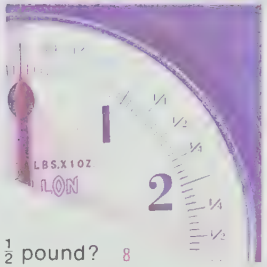
   **a** The numbers look like those on a clock. How is the scale's face different from a clock?
   Scale has 0 instead of 12. Scale has one hand; clock has two hands.

   If you put something in the pan below, the weight pulls on a spring. The spring is connected to the pointer. The pointer moves and shows how much the object weighs.

   **b** If the hand goes around only once, what is the most weight this scale could show?
   12 lb (Most will answer 11 lb. Extend understanding if this happens.)

2. Look at just a small part of the face. Here is an enlarged picture of the part from 0 to 2.

   The number line from 0 to 1 has 16 marks. Each mark stands for 1 ounce. There are 16 ounces in 1 pound.




   **a** How many ounces in $\frac{1}{2}$ pound? 8

   **b** How many ounces in $1\frac{1}{2}$ pounds? 24

239

**goal** Investigating how to read a scale

**page 239** When learning to read a scale, look first for large units (pounds), then for the subunits (ounces). The smaller the unit, the more exact the measure. A scale showing ounces may be compared to a number line on which fractional parts are marked. On a scale, each ounce is $\frac{1}{16}$ of a pound. Whether or not ounces are important depends upon what is being weighed and for what purpose. Generally, we are satisfied to know our body weight in pounds—perhaps to the nearest $\frac{1}{2}$ pound. When buying food, we want to pay only for the exact amount received.

**goal** Learning to read a bathroom scale

**things** bathroom scale, if available

**page 240** If you can locate a spare bathroom scale, now is the time to have it in the classroom. There is no better way to learn how to read a scale than to actually weigh someone. Youngsters can work in small groups and record each other's weight. Think of the practice possible!

You decide how best to handle this page with your students.

**1.** Here's another scale. It is the kind most people use to weigh themselves.

The number line moves on this scale. You can see only part of it at one time.

**a** Can you figure out why the 300 is marked on the scale? What does it stand for? 300 lb.

Look at just a small part of the scale's number line.

**b** Here's a surprise. Most scales are marked like this. How many marks does it have? What does each mark stand for? 9 between numbers; 1 lb.

This scale does not record ounces. It shows pounds. The heavy mark between 0 and 10 shows 5 pounds.

**2.** What weight does each scale show?

**a**

65 lb.

**b**

$80\frac{1}{2}$ lb.

**c**

120 lb.

240

Ounces are important, though.

Ounce weight of a letter tells you how much postage you must pay.

Ounce weight is the amount of cough medicine you should take.

Ounce weight is used to tell the amount of money to be paid for spices and perfume, and sometimes gold and silver.

Remember—there are 16 ounces in 1 pound.

In metric measure, grams are used as the measure for light things. It's hard to feel just 1 gram. It takes more than 28 grams to make 1 ounce! If you hold two metal paper clips in your hand, you have about 1 gram of weight.

Are you ready for a big number? There are 1000 grams in 1 kilogram.

Do you think that a scale that records kilograms would also record grams? Think how a number line would be marked to show 1000 parts between 0 and 1.

Do you know what a kilogram feels like? Pick up two things that each weigh about 1 pound. They weigh about a kilogram. But a weight of 1 kilogram is really closer to $2\frac{1}{5}$ pounds.

241

**lesson** Pages 241, 242

**goal** Developing an intuitive feel for an ounce, a gram, and a kilogram

**things** 5 quarters
paper clips
objects that weigh about 1 lb.

**page 241** There is no better way of learning than by doing. Have your pupils actually manipulate the quantities given for an ounce, a gram, and a kilogram. *Find something in the room that weighs about the same. How many agree?*

*Which unit can measure a smaller amount, an ounce or a gram?* Imagine the number of paper clips in a kilogram!—or in a pound! Realizing what tiny amounts can be measured with the metric system may help youngsters understand why scientists use this system.

Send Curious George, who is interested in about how many grams there are in a pound, to a reference source. He may or may not have the ability to estimate, knowing each ounce is about 28 grams.

**goal** Examining the metric scale; shopping for bargains

**page 242** When working problem 2, pupils will probably think of the nonmetric weight first. It may be necessary to recall that a kilogram is a little more than 2 pounds. Grams are necessary for items that weigh considerably less than 1 kilogram. You will find commercial products that weigh more than 500 grams or more than 1 kilogram but less than 2 kilograms marked with a decimal fraction.

Talk about problem 4. Labels are often deceiving. The wise shopper stops to read before buying a **bargain.** Encourage pupils to look for actual examples of shopping bargains in newspaper ads.

**1.** Pretend you are in France.
You're in a small grocery store.
You see this kind of scale:

They use metric measure in France, so the scale is marked in kilograms.

There is a pan on top to hold the object to be weighed.

The scale's face isn't big enough to show the 1000 grams in 1 kilogram.
So there is another scale
to show grams. It looks like this:

**2.** Metric weights are marked on packages in the United States, too.
Would these items be weighed in grams or kilograms?

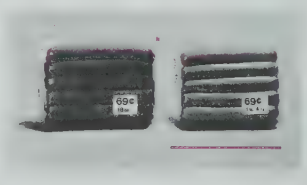
**a** A package of butter — grams or kilograms
**b** A package of meat — kilograms
**c** A can of coffee — kilograms
**d** A bag of potatoes — kilograms (and grams)
**e** A loaf of bread — kilograms
**f** A watermelon — kilograms

**3.** Can you find a package label that has metric units of weight marked on it?
Look at home. Many packages have both customary and metric weights. Example: tea—4 oz. (113 g)

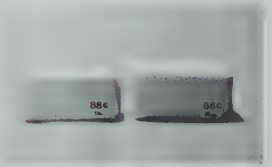
**4.** What is the best bargain?

**a**

**b**



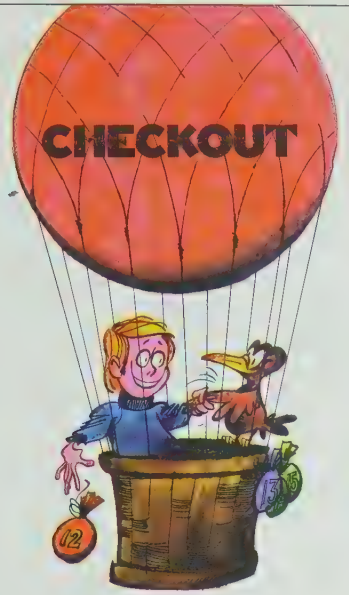

**c**




Keep your eyes open when you have a choice of two brand names. One might save you money.

Both weigh and cost the same amount.

242




Skill: Selecting an appropriate unit of measure

**1.** Tell if each sentence is true or false.

**a** A letter you get in the mail weighs at least 1 kilogram. False

**b** A pound of potatoes weighs less than a kilogram of potatoes. True

**c** If you were in France, you probably could buy a litre of milk. True

**d** A pound of feathers weighs less than a pound of chicken. False

**e** The doctor might say you should take a pound of medicine 3 times a day. False

Skill: Reading scales

**2.** What weight is shown on each scale?

**a**

This scale measures pounds. 9 lb. 8 oz. or $9\frac{1}{2}$ lb.

**b**

This scale measures grams. 350 g

**c**

This scale measures pounds. 181 lb.

**lesson** Page 243

**goal** **Checkout**—selecting an appropriate unit of measure; reading scales

**page 243** You will want to read the parts of the first question for youngsters who have reading problems. Give them time to think and then to jot down their answers. No one should have difficulty reading the scales.

Those pupils who aren't with it simply need lots more real-life experiences with weight. They need to see and use more scales. These experiences will be acquired in time.

Go to the grocery store on a shopping trip—a real one or a let's-pretend one with newspaper ads. If you have a cafeteria, ask the cooks to let your youngsters come down and snoop. The big quantities of food ordered for a lunchroom come in wonderfully big packages. Who would think that you could buy a gallon of olives or pickles? Wow!

# RESOURCES

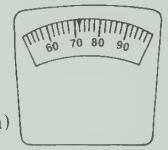
## another form of evaluation

**for Checkout**—page 243

1. Tell if each sentence is true or false.
   a) A nurse gives a shot that has 3 litres of medicine. False
   b) A pound of candy weighs less than a kilogram of caramels. True
   c) In France you might buy a litre of soft drink. True
   d) A pound of steel weighs more than a pound of soap suds. False
   e) A dog weighs 1 ounce. False

2. What weight is shown on each scale?

a)




This scale measures kilograms. 72 kg

b)

This scale measures grams. 10 g

c)

This scale measures pounds. 1½ lb.

## additional learning aids

**concept**—chapter objectives 1, 2, 3

**SRA products**

*Mathematics Involvement Program*, SRA (1971)
Cards: 325

**other learning aids** (described on page 264g)—
Equal Pan Scales, Learning about Measurement, 100 g Balance

# Try this.

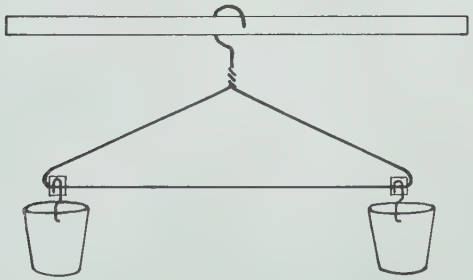
## You need:

1 hanger
2 paper clips
2 paper cups
Tape

## Do this.

1. Open the paper clips like this.

2. Push the bottom loop of the paper clip through a paper cup.
3. Hang the top loop of the clip on the hanger.
4. Put some tape over each paper clip so it doesn't slide along the hanger.
5. Hang the hanger on a horizontal stick so the hanger can swing.



## Try these things at home.

Fill one cup with dirt. Find some things that weigh the same as one cup of dirt. (The hanger will balance when both cups hold the same weight.) Try sand, rocks, and things like that.

Next time fill one cup with water. Find things that weigh as much as one cup of water.

© 1974, SRA. Permission to reproduce for school use.

# 13 GRAPHS AND CHARTS

**before this chapter the learner has—**

1. Worked with customary and metric measurements
2. Measured heights and weights

**in chapter 13 the learner is—**

1. Learning to read various types of graphs
2. Preparing a simple tally chart
3. Preparing a graph to illustrate the information on the tally chart

**in later levels the learner will—**

Master preparing a bar graph

# Notes & Things

This is a

## grand & glorious

chapter. It allows everyone to have fun collecting and organizing their own information and then taking a look at other ways of presenting information. Be prepared for a deluge of clippings that come from home. You probably will have every bulletin board and every wall covered with homemade graphs and a wild variety of graphs and charts from every source imaginable. That's good! By the time everyone gets to the end of the chapter, there will be criteria for sorting the graphs and charts according to the type of graph and then into subcategories of good ones and bad ones.

This is an exploratory chapter full of activities. Everyone will have something to contribute and something to learn. Exciting lessons in social studies and science could bloom from the seeds planted in this chapter.

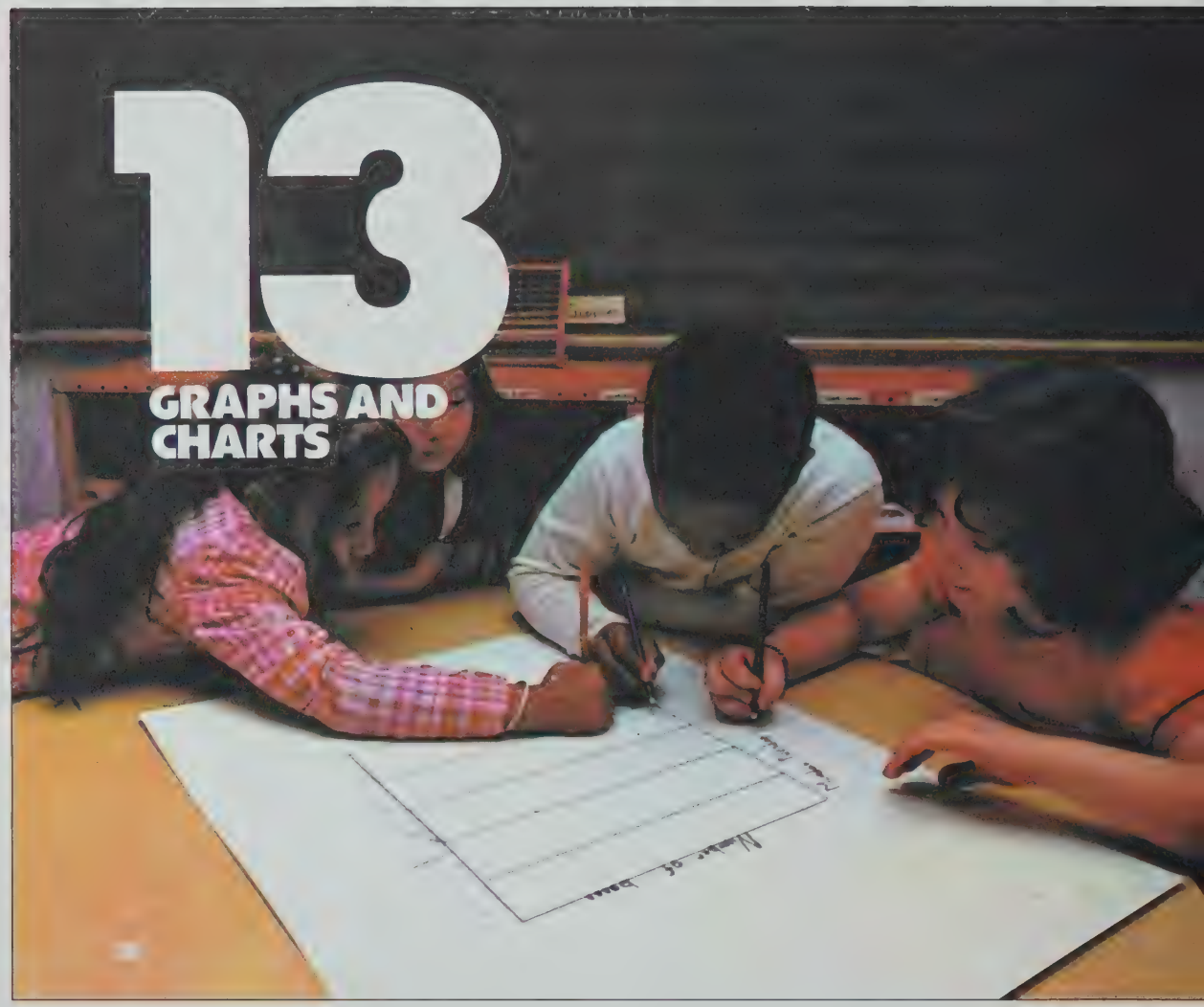
### things

large-square graph paper
collection of graphs from magazines and newspapers

**goal** Think about and explore ideas through a picture clue

**page 244** The people in this photograph are working together on a project. Does anyone guess that they are getting ready to show information by means of a graph? If they don't guess something close to that, it will be much better to skip any forced discussion and go directly to the next page. The children's finished product is shown there.

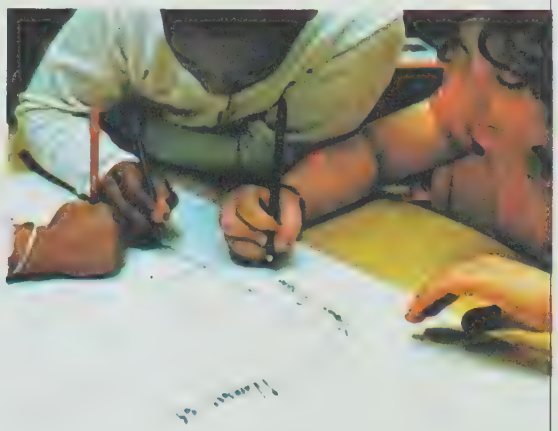
If some do know that the children in the picture are making a graph, investigate why they think a graph may be a better way to show information than a written report, for example. Our television-age pupils may be surprisingly sophisticated about how to best show comparisons. Maybe they have even heard the old saying: "A picture is worth a thousand words." Hope that they will all come to appreciate the value of graphs by the end of this chapter.



This is a special kind of picture.
It tells a story without many words.
What story could the picture tell?

Answers may vary.
Example: How many boxes were needed each day of 1 week

Information organized in this kind of picture is called a graph. Try to find graphs in newspapers or magazines. Ask if you can bring them to class. Your goal—find out what graphs and charts tell you.



245

**lesson** Pages 245, 246, 247

**goal** Introduction to graphs as a way to show information

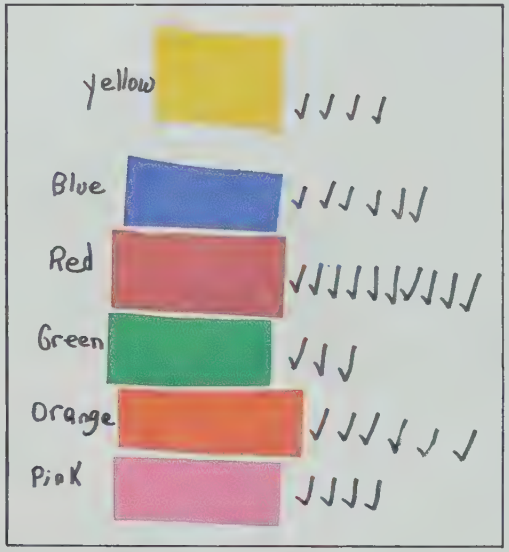
**page 245** Most of your pupils will have seen a graph before. Examine the graph on the page together. Ask questions to determine how much information they can discover. *How do we know what the picture is about? How many boxes are shown for Monday?* Continue with questions regarding the remaining days. *Do you think the picture shows the number of boxes needed each day? Could it show the number brought each day? Which day shows the most boxes? the least? What do you suppose will be done with all the boxes?* Encourage pupils to collect examples of graphs they find in newspapers and magazines. This collection will be used for a later lesson.

**goal** Developing a tally system for recording information

**page 246** Have fun with this group project. Let the youngsters pick the colors for the list to be circulated. Have them tally the results on the chalkboard. What is their favorite color?

There are many ways you can put information together without using many words.

Jake's class wanted to know what the favorite color was in the class. They decided to pick from six colors. They listed the colors on a sheet of paper. Each person picked one favorite color and put a check mark by that color. Here's the finished list.

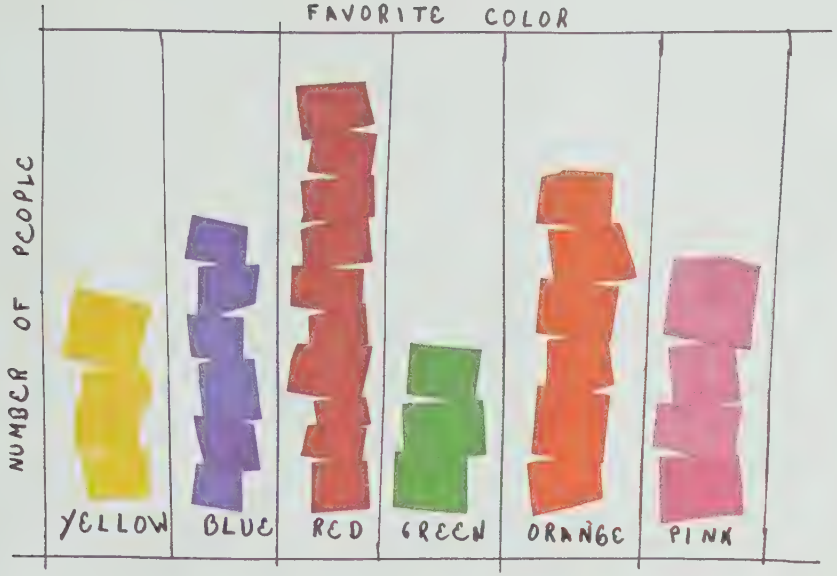



246

1. There were 33 people in class. Did everyone pick one color? How do you know?
   Yes By counting the checks; there are 33.
2. What color did most people like? How do you know? Red
   Red has the most checks.
3. What was the next favorite color? How do you know? Blue and orange tied. Blue and orange both have 6 checks.
4. What was the color the least number of people liked? Green
5. Do you think most people in your class would like red? Find out.
   - **a** Prepare a list of colors to pick from
   - **b** Pass the list around the class and have every person pick one color.
   - **c** Make sure everyone has picked one color, and then report the results.

   Answers will vary.

Jake's class decided to make a graph of the results.
They found a piece of paper and made this graph.




1. One square stands for one person's choice.

   **a** What other information is on the graph?
People in Jake's class, range of colors chosen, number choosing each color

   **b** Does this graph quickly show the favorite color? Yes

   **c** Make a graph to show the favorite colors picked by your class.

2. Have you found any graphs that look something like this?
   If so, what information is on the graph you found? Answers will vary.



**goal** Preparing a graph to show information gathered

**things** commercial large-square graph paper

**page 247** Discuss the graph pictured. Emphasize that the title is a necessary part of every graph—the reader must know what the graph is about. The information given **horizontally** and **vertically** must also be clearly indicated.

Graphs are more meaningful to learners when developed from information that they themselves have gathered. Have each youngster make his own graph to show the group's favorite colors. Use large-square graph paper.

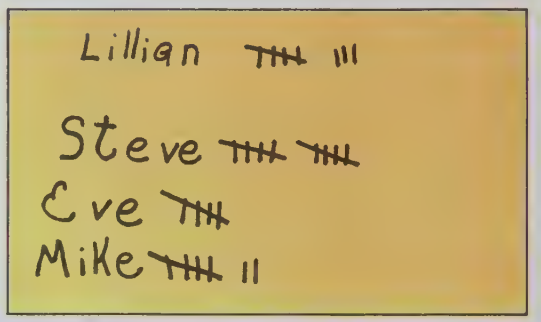
**lesson** Pages 248, 249, 250, 251

**goal** Practice in tallying information

**page 248** There is lots of reading in the introduction. Do you have a good oral reader to take the lead? Make a big deal out of the tally marks. What could they possibly mean?

List all the possible subjects that could be named as favorites in the last problem. Decide which ones to leave on the list. Keep only as many as the youngsters can manage to put on a graph. Collectively decide how to make the tally chart. After the entries are made, each pupil makes his own tally marks as the votes are called off.

Four people in David's class had each finished a really good science project. The class wanted one of the four to tell the principal about the projects. The class voted to see who that one person should be. Each person wrote the name of one of the four people on a slip of paper and brought it to the teacher to be counted. The teacher asked David to keep count of the votes. Here is David's chart:




1. How many votes does 𝍸 stand for? 5

2. How many votes were counted in all? 30

3. Who was selected to present the projects to the principal? Steve

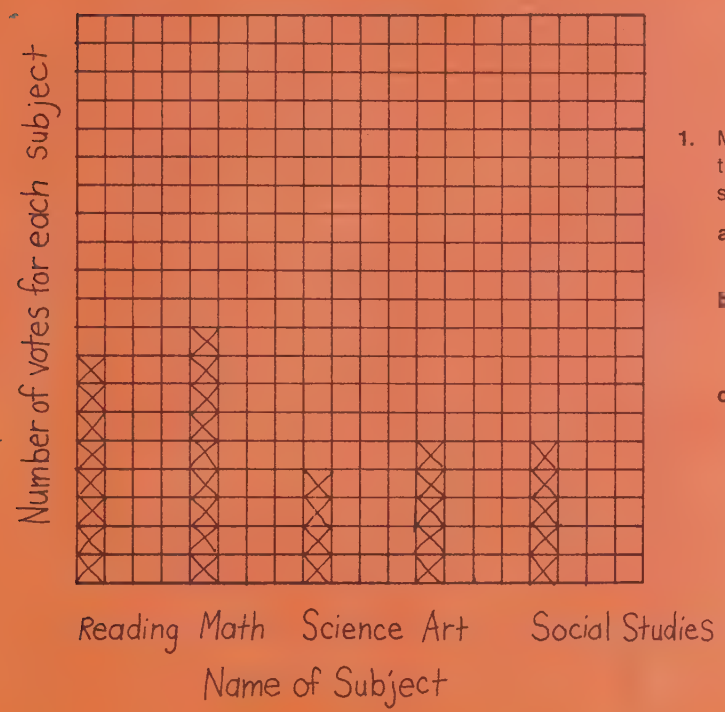
4. If that person happens to be out of school the day of the presentation, then who should do it? Lillian

The chart that David made is called a tally chart. Each single vote was recorded. The class had a tally of the total number of votes.

5. Have your class vote on their favorite subject in school. Each person should write down his favorite subject on a sheet of paper. Collect the sheets. Your teacher will read the votes while you make a tally chart of the results.

Answers will vary according to results of the project.

248




1. Make a graph like the one on this page. Show the favorite subjects of your class.
   - **a** Make sure you have a title for your graph.
   - **b** Write the name of the subjects along the bottom of your graph.
   - **c** Let one square stand for each vote. A count of all of the squares marked should be the same as the number of tally marks.



**goal** Making a graph to organize and show collected information

**things** graph paper

**page 249** You decide who is capable of making the graph independently—perhaps this should be a group project. Deciding on the information to go on the graph will involve some good discussion. But let everyone decide for himself what information he thinks is necessary. Then the various results can then be compared.

**goal** Practice in tallying information and making a bar graph to show this information

**things** graph paper

**page 250** You may need to give some help to set up a tally chart and get information from each child in the class. *How many families with only one member? There aren't any? That means we don't mark any squares in that column* —and so on. Remind the youngsters that they need a title and vertical and horizontal labels.

Save these graphs for page 251.

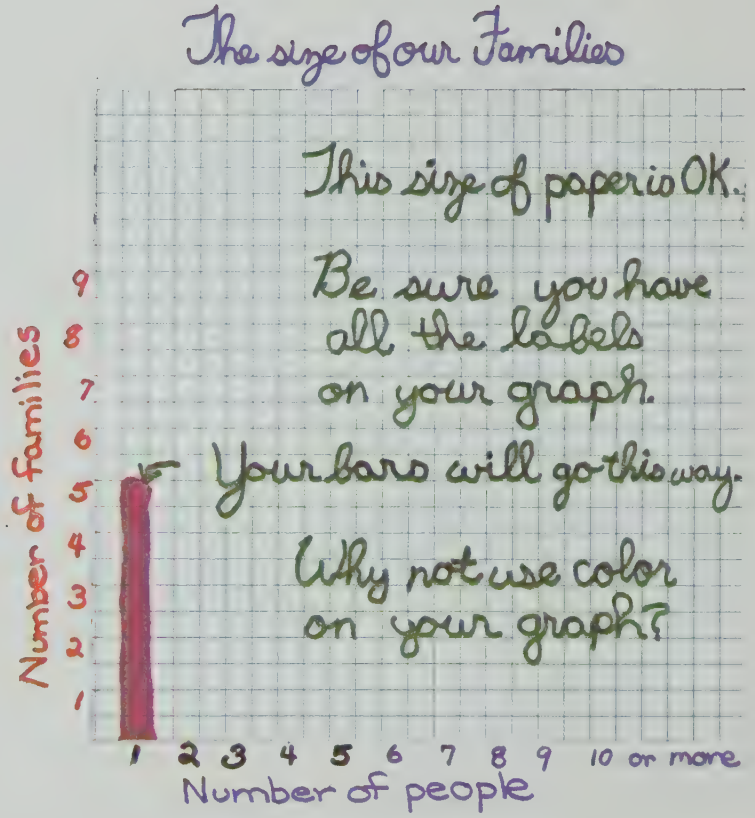
Answers will vary according to results of the project.

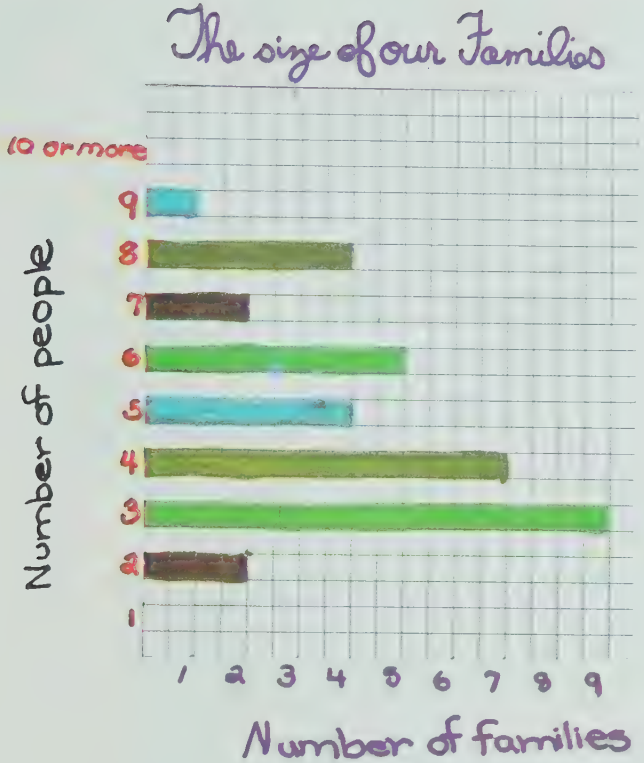
How many people in your class have big families? How many have small families? Could you make a graph to show how many families there are of each size? Yes

First you have to decide what a family is. No fair counting your cat or dog —only people! Don't forget to count YOU.

Then you have to tally information for the whole class. Finally, you make your graph. Be sure to use all the labels that are on the sample graph.

250






Sometimes you will see a graph like the one you just made turned sideways. Here is the graph of family size for Phil's class.

1. How is this graph like your graph? It should show similar information.
2. How is it different from your graph? It's sideways and the actual frequencies will differ.
3. Would the numbers on the left side have to go up to 10? No. Since there are no "10 or more," you could eliminate it.
4. Does your graph tell the story better than this graph?
   Discuss. It'll tell *your* story better. Neither graph is "better."



**goal** Comparing two bar graphs

**things** graphs from page 250

**page 251** The youngsters will need their graphs from page 250 so that they can compare the vertical bar graph with the horizontal bar graph in the text.

*Does any column on the graph you made show the same number as a row on this graph?*

**lesson** Pages 252, 253, 254, 255

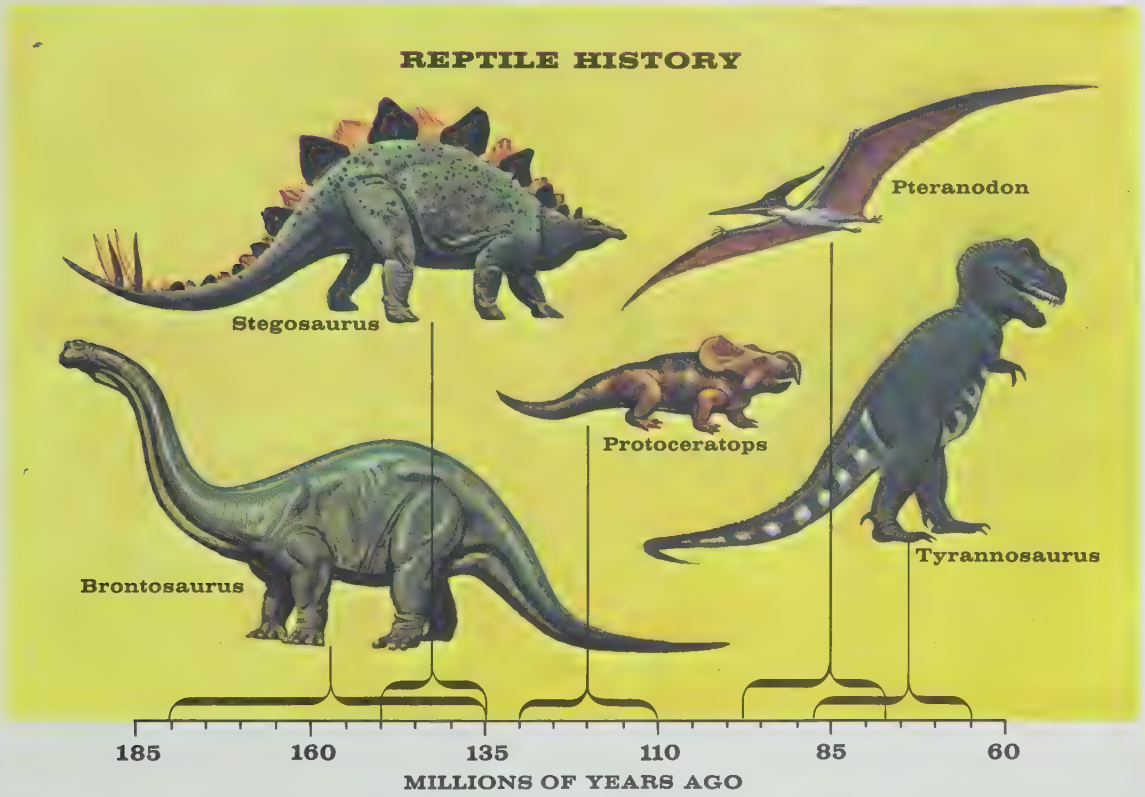
**goal** Examining a picture graph

**page 252** This picture graph has no title. *Can you guess what information is being pictured? Why is a title so important? What would be a good title?*

Go on to page 253.

Sometimes pictures are used instead of marked squares.
What information does this graph give? This picture graph tells the altitude (height) of various types of clouds.

Sometimes pictures are put on a graph to give information.
Does the picture help you understand what this graph is all about?
Yes. It gives a clearer idea of the type of animal that existed in different eras (time periods).




253

**goal** Examining a different type of picture graph

**page 253** This graph should tap the interests of many children, but it will take some time and some good thinking to find out what information is being shown. Decide what the scale tells. Good old Brontosaurus was around as early as 176 **million** years ago. 176,000,000 years ago is a mighty long time. Thank goodness the youngsters have an intuitive curiosity about prehistoric animals.

Compare the two picture graphs. *Does each graph have a title? How are these graphs different?* (One has a vertical scale; the other a horizontal scale.) *Could the graph that shows the history of reptiles be compared to a number line? Why do the numbers on the horizontal scale get smaller as we move to the right?* (We are moving nearer to today.)

**goal** Examining a circle graph and a line graph

**page 254** The youngsters have not had much experience with the fraction $\frac{1}{10}$. Find out if they can transfer their knowledge of fractions to this situation. *The graph says $\frac{8}{10}$ of the people live in metric countries. What does $\frac{8}{10}$ mean? What does it mean when it says $\frac{8}{10}$ live in metric countries?* Find out how much your pupils remember about metric units of measure. See if you can get someone to call this a circle graph by asking how this graph is like the others and how it is different.

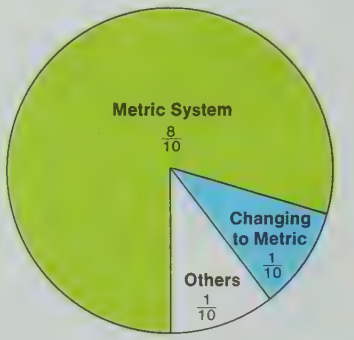
One goal of this page is understanding that a circle graph can present only one type of information. The line and bar graphs can present two types of information. This is a hard concept.

Maybe you have found graphs that look like this:

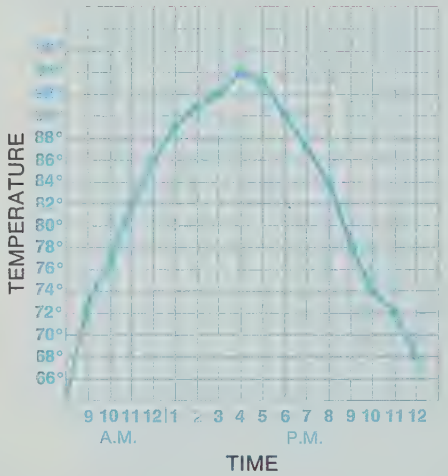
Eight-tenths of the people in the world live in countries using the metric system.

One-tenth live in countries that are changing to the metric system.

What information does this graph tell you?
$\frac{9}{10}$ of the world is using or is going to use metric measure; $\frac{1}{10}$ of the world is not planning to use it.




This graph looks different too.




What information can you get from this graph?*

What should the title of the graph be?**

*It tells temperature every hour of that day from 9 A.M. to 12 midnight. It also shows the rise and fall of temperature.

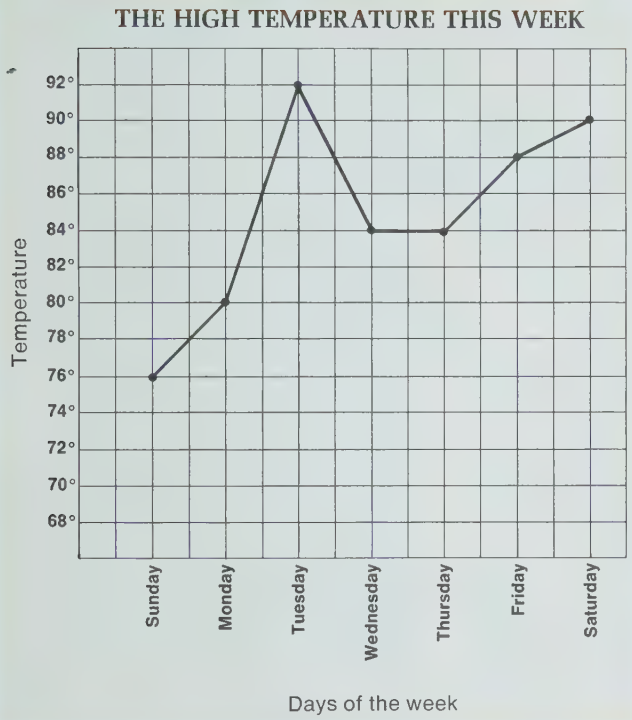
**Answers will vary. Examples: TIME/TEMPERATURE GRAPH; TEMPERATURE READINGS FOR 1 DAY; TEMPERATURE CHANGES

254

The circle graph provides an opportunity to extend learning. Imagine that you live in a metric country. *How would you measure a piece of ribbon?* (Centimetres) *the size of this room?* (Metres) *a box of candy?* (Grams)

Send the youngsters on a hunt for labels used on cans of food or boxes of candy that show the weight in metric units as well as in customary units.

Scientists all over the world already use metric measurement. *Do you think that someday everyone in the world will use metric measurement? Why?*




1. Here is another graph about temperature. What does this one tell about?

2. Read the graph.
Answer the questions.

   a What was the temperature on Sunday?

   b Monday?

   c Tuesday?

   d Wednesday?

   e Thursday?

   f Friday?

   g Saturday?

   h What was the hottest day of the week?

   i What was the coolest day of the week?



**goal** Examining a line graph

**page 255** Here is a good, simple line graph to study. It fits all the textbook requirements for a broken-line graph and can be the basis on which you determine how much learning has taken place. Perhaps the pupils will begin to understand that the type of graph selected is a function of the information to be shown. The broken-line graph is used to show information that is always changing, such as temperature.

Extend the discussion. *Do you suppose it was 80° all day Monday? Did the temperature go up or down from Sunday to Monday? from Monday to Tuesday?* Continue the questioning as long as there is interest.

Take your clue from the pupil page. Have your pupils record each day's high temperature for one week. Then let them build a graph on the basis of their own information.

Recording and graphing each day's low temperature for a week is another possibility.

**lesson** Pages 256, 257

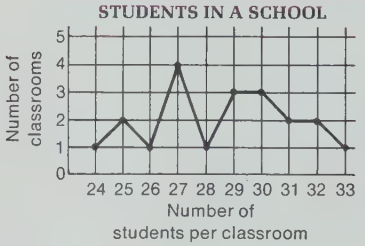
**goal** Comparing different types of graphs

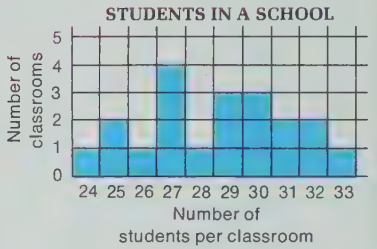
**page 256** Bar graphs can best be used to show information that is constant and can be counted. Line graphs are best used to show changing information. Which is the better graph to use for the information in the first problem? Why?

There is no way to put the information regarding the number of students per classroom into one circle graph. But if someone thinks it's possible, let him try.

Help learners to see that the number line along the bottom and along the side of any bar or line graph can be switched. It is very important to label both lines so that the reader can clearly understand the information being shown.

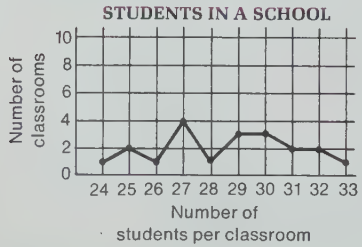
**1.** How are these two graphs alike? Both show the same information.
How are they different?
Answers will vary. Example: One may be easier to read.



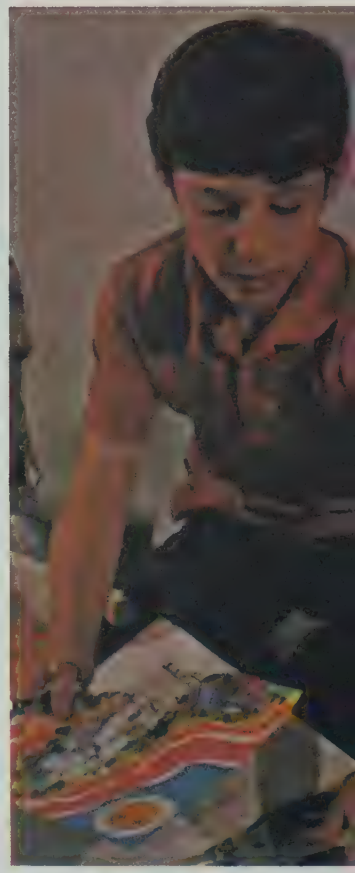




Could this information be put in the form of a circle graph? Probably not.

**2.** The column of numbers along the side of a graph and the row of numbers along the bottom of a graph are very important. Why don't the numbers along the bottom of these two graphs start at zero?
If your smallest class has 24, then from 0 to 24 on the graph would be wasted space.




**3.** Does this graph give the same information as the two above? Yes
How? The scale is just different—the numbers on the left go up by twos instead of by ones as in the graphs above.



256

You have been collecting pictured information from newspapers and magazines. Sort out your collection. Be ready to talk about these questions.
Answers will vary according to individual collections.

1. Some graphs like those you have made are called bar graphs. Why do you think they have that name? Do you have any bar graphs in your collection? What information is presented in each bar graph you have? They look like bars

2. You also looked at some graphs called pictographs. Can you look back and find the kind of graph that might have a name like this? Where could the name come from? Do you have any pictographs in your collection? See page 252 Pictures used

3. You know why the name circle graph is given to some graphs. Can you find an example of a circle graph in this chapter? Do you have any circle graphs in your collection? See page 254

4. There are many other kinds of graphs. If you have some other kinds in your collection, give them a name. Be ready to explain why you picked the name you did. Encourage discussion

5. Some graphs are easier to understand than others. Pick out your favorite one. Tell why you think it is the best one.
Encourage a discussion of reasons for choice



**goal** Examining the pupils' collections of graphs

**things** pupils' collections of graphs

**page 257** This page is a group project. The youngsters will first need time to sort their collections of graphs before discussing the questions.

When the page activities are completed, the collections of graphs can make an interesting bulletin board. In case your pupils have forgotten to bring graphs, you should have a supply available.

The youngsters could also make a small scrapbook containing examples of the various types of graphs discussed on the page.

**lesson** Pages 258, 259

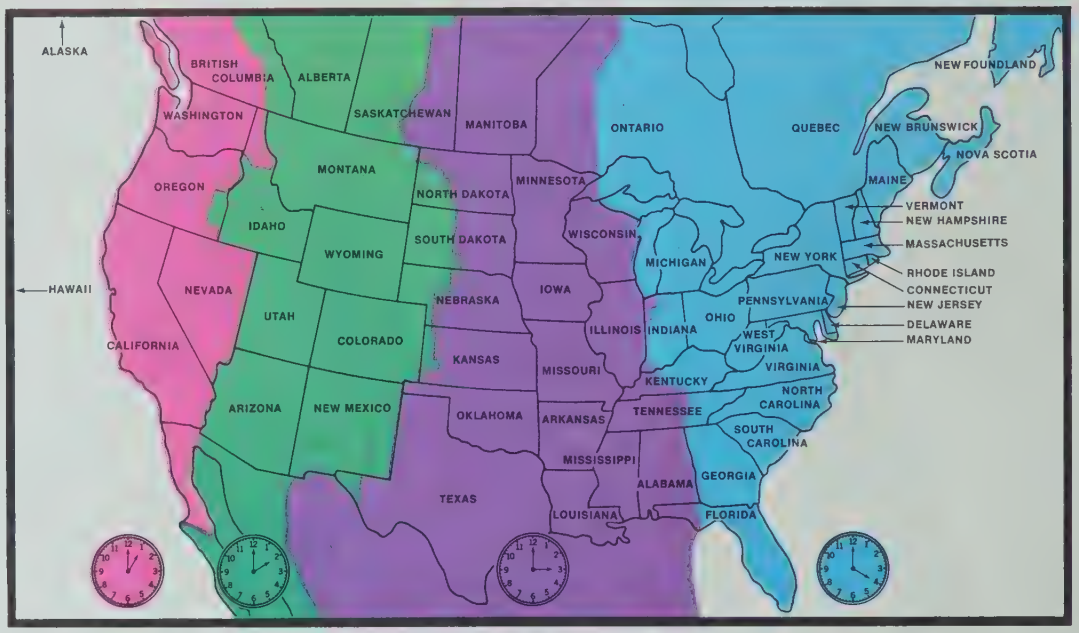
**goal** Examining a time-zone chart

**memo** Some pupils may have already brought some charts to class, thinking that they were graphs. There is a narrow line between a pictograph and a chart like the one on this page. Don't expect the children to know the difference at this point. They will know later, after they have had more experience.

**page 258** The dotted and heavy black lines indicate time zones. Youngsters who live near the edge of a zone are well aware of the hour time differences between two cities. This is a good lesson in map reading and geography as well as in mathematics. Locate your own town. Compare the time with that of locations in other time zones.

What information can you get from this picture?

Time zones of parts of U.S. and Canada




1. When it is 4:00 in South Carolina, U.S.A., what time is it in Alberta, Canada? 2:00
2. When it is 12:00 noon in Oregon, what time is it in Quebec? 3:00
3. When it is 7:00 in Missouri, what time is it in Minnesota? 7:00
4. When it is midnight in Florida, what time is it in Maine? in Ohio? in New Jersey? in British Columbia?
   Midnight Midnight Midnight Either 9:00 P.M. or 10:00 P.M., depending on where in British Columbia

258

Tally charts and graphs are not the only ways to picture information. What does this chart show?
The title tells you.

**ROAD DISTANCES BETWEEN PRINCIPAL U.S. AND CANADIAN CITIES MEASURED IN LAND MILES**

| | Atlanta, Ga. | Boston, Mass. | Chicago, Ill. | Dallas, Tex. | Denver, Col. | Los Angeles, Calif. | Montreal, Quebec | St. John, N.B. | Vancouver, B.C. |
|---|---|---|---|---|---|---|---|---|---|
| Atlanta, Ga. | — | 1074 | 703 | 813 | 1417 | 2209 | 1289 | 1540 | 3001 |
| Boston, Mass. | 1074 | — | 993 | 1817 | 1989 | 3167 | 327 | 436 | 2761 |
| Chicago, Ill. | 703 | 993 | — | 938 | 1018 | 2104 | 865 | 1385 | 2193 |
| Dallas, Tex. | 813 | 1817 | 938 | — | 786 | 1406 | 1871 | 2170 | 2296 |
| Denver, Col. | 1417 | 1989 | 1018 | 786 | — | 1116 | 1916 | 2423 | 1412 |
| Los Angeles, Calif. | 2209 | 3167 | 2104 | 1406 | 1116 | — | 3040 | 3504 | 1320 |
| Montreal, Quebec | 1289 | 327 | 865 | 1871 | 1916 | 3040 | — | 580 | 2940 |
| St. John, N.B. | 1540 | 436 | 1385 | 2170 | 2423 | 3504 | 580 | — | 3520 |
| Vancouver, B.C. | 3001 | 2761 | 2193 | 2296 | 1412 | 1320 | 2940 | 3520 | — |

Plan a trip to go to three cities on this chart. Tell the total number of miles you would travel from the first city to the third city. Answers will vary with cities chosen.

Do you have a travel agency close by? Do any parents travel by plane? Have you traveled by plane? Does anyone have an airline map? Using one is a great adventure. Would the distances be less if you traveled by plane rather than in a car? Use the airline map and find out.

**goal** Examining a mileage chart

**page 259** You might want to remind your pupils of the addition and multiplication charts they have used. They will use this chart in the same way as the fact charts, but it contains different information—distances between two cities are shown.

Try several examples. *How far is it from _____ to _____ ?* Locate a major city near you. *If you lived in _____, where would you like to go on a vacation?* Find the distance from the chart. Pick other cities. *If you lived in Vancouver, where would you like to go on a vacation?* Continue for as much practice as is needed.

Most road maps have charts similar to this one. An atlas has them too. These sources will allow lots of practice. It might even be fun to see if different sources agree with each other.

**lesson** Pages 260, 261

**goal** Examining height and weight charts

**memo** Pages 260 and 261 must be used together. Please also review the commentary for page 261 before you start using the pages.

**page 260** Do some work with the chart before you start asking questions.

In chapter 12, pupils reported their weights. The relationship of height, body structure, and weight were examined. Here they are looking at the results of a survey of youngsters across the country.

The charts give information based on an **average**—not on specific youngsters. To help pupils understand the concept of an average, take a sample of 5 actual weights of pupils in your class. Add these weights; then divide by 5 to determine their average weight. Repeat for other groups of 5.

Compare the averages found for the various groups. Are all the averages identical? Is this weight the true weight for each member of that specific group? for each member of the class? A comparable experiment may be done for heights.

The U.S. Department of Education keeps many records. The heights and weights of thousands of schoolchildren are recorded. These facts tell what the average person weighs if he is a certain height. Look at and think about the charts on the next page.

1. The charts start with boys and girls who are ten years old. Why do you think ages younger than ten are not on the charts? Discuss: Individual differences, rapid growth rates, daily variations, and so on. Also, many schools do not weigh and measure below grade 3—no data to report.
2. If a boy and a girl are the same age and same height, should their weight also be the same? No
3. What happens to the average weight when the height increases? It also increases.
4. If two boys are the same height but different ages, are the weights the same? Not necessarily.
5. Why do you think the first height for boys in the chart is 52 inches and the first height for girls is 49 inches? Are boys always taller than girls? No
   At 10–11 yrs., boys are usually taller than girls.
6. Does the chart say that a ten-year-old boy must be 52 inches tall? Can a ten-year-old girl be less than 49 inches tall? No Yes
7. What happens to average height as boys and girls get older? What happens to average weight as they get older? Increases Increases

260

## BOYS between 10 and 16 years
### in school clothes, without shoes

| HEIGHT (in inches) | AVERAGE WEIGHT in pounds for each specified age and height | | | | | |
|---|---|---|---|---|---|---|
| | 10-11 yrs. | 11-12 yrs. | 12-13 yrs. | 13-14 yrs. | 14-15 yrs. | 15-16 yrs. |
| 52 | 64 | 64 | 64 | — | — | — |
| 53 | 67 | 68 | 68 | — | — | — |
| 54 | 70 | 71 | 71 | 72 | — | — |
| 55 | 73 | 74 | 74 | 74 | — | — |
| 56 | 77 | 77 | 78 | 78 | 80 | — |
| 57 | 81 | 81 | 82 | 83 | 83 | — |
| 58 | 84 | 85 | 85 | 86 | 87 | — |
| 59 | 88 | 89 | 89 | 90 | 90 | 90 |
| 60 | 92 | 92 | 93 | 94 | 95 | 96 |
| 61 | 95 | 96 | 97 | 99 | 100 | 103 |
| 62 | 100 | 101 | 102 | 103 | 104 | 107 |
| 63 | 105 | 106 | 107 | 108 | 110 | 113 |
| 64 | — | 109 | 111 | 113 | 115 | 117 |
| 65 | — | 114 | 117 | 118 | 120 | 122 |
| 66 | — | — | 119 | 122 | 125 | 128 |
| 67 | — | — | 124 | 128 | 130 | 134 |
| 68 | — | — | — | 134 | 134 | 137 |
| 69 | — | — | — | 137 | 139 | 143 |
| 70 | — | — | — | 143 | 144 | 145 |
| 71 | — | — | — | 148 | 150 | 151 |
| 72 | — | — | — | — | 153 | 155 |

## GIRLS between 10 and 16 years
### in school clothes, without shoes

| HEIGHT (in inches) | AVERAGE WEIGHT in pounds for each specified age and height | | | | | |
|---|---|---|---|---|---|---|
| | 10-11 yrs. | 11-12 yrs. | 12-13 yrs. | 13-14 yrs. | 14-15 yrs. | 15-16 yrs. |
| 49 | 56 | — | — | — | — | — |
| 50 | 61 | 62 | — | — | — | — |
| 51 | 63 | 65 | — | — | — | — |
| 52 | 65 | 67 | — | — | — | — |
| 53 | 68 | 69 | 71 | — | — | — |
| 54 | 71 | 71 | 73 | — | — | — |
| 55 | 74 | 75 | 77 | 78 | — | — |
| 56 | 78 | 79 | 81 | 83 | — | — |
| 57 | 82 | 82 | 84 | 88 | 92 | — |
| 58 | 86 | 86 | 88 | 93 | 96 | 101 |
| 59 | 90 | 90 | 92 | 96 | 100 | 103 |
| 60 | 95 | 95 | 97 | 101 | 105 | 108 |
| 61 | 99 | 100 | 101 | 105 | 108 | 112 |
| 62 | 104 | 105 | 106 | 109 | 113 | 115 |
| 63 | — | 110 | 110 | 112 | 116 | 117 |
| 64 | — | 114 | 115 | 117 | 119 | 120 |
| 65 | — | 118 | 120 | 121 | 122 | 123 |
| 66 | — | — | 124 | 124 | 125 | 128 |
| 67 | — | — | 128 | 130 | 131 | 133 |
| 68 | — | — | 131 | 133 | 135 | 136 |
| 69 | — | — | — | 135 | 137 | 138 |



**goal** Reading a statistical chart

**page 261** Help the youngsters learn to read the chart by describing a friend of yours—a girl who is 60 inches tall and $12\frac{1}{2}$ years old. To find about how much she might weigh, encourage them to—

- find the girls' chart;
- go down the first column to 60 inches;
- place a piece of paper under the 60 row;
- find the 12-13 column;
- go down the 12-13 column to the 60 row;
- name the average weight shown.

Describe a boy in much the same way. Provide more practice before going back to the questions on page 260.

**lesson** Page 262

**goal** Finding information on a calendar

**page 262** This may be a good time for the rhyme "Thirty days hath September . . ." Put the supersleuth detectives to work. *Do you think every December calendar page looks like this, no matter what year it is?*

Discuss the questions together. Compare the calendar for December shown with one for the current year. *How are they alike? different?* Check January, March, May, July, August, and October. *Are any of the calendars for these months exactly the same?*

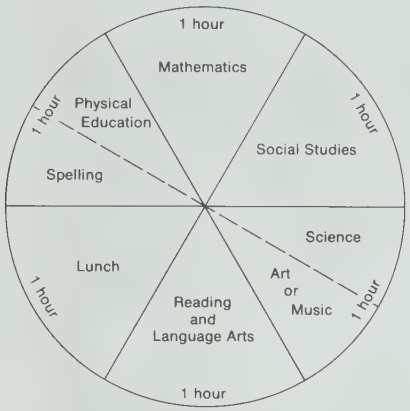
# Here is a type of chart you probably see every day.

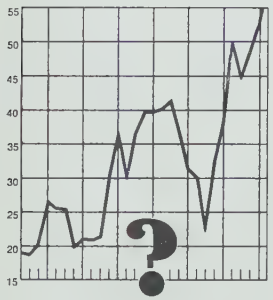
| 1999 | | | DECEMBER | | | 1999 |
|---|---|---|---|---|---|---|
| S | M | T | W | T | F | S |
| | | | 1 | 2 | 3 | 4 |
| 5 | 6 | 7 | 8 | 9 | 10 | 11 |
| 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| 19 | 20 | 21 | 22 | 23 | 24 | 25 |
| 26 | 27 | 28 | 29 | 30 | 31 | |

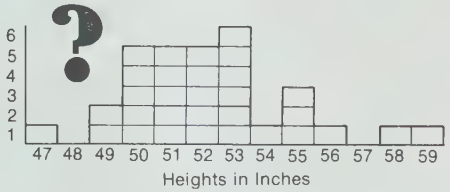
1. What month is shown on this calendar? December
2. What year is shown? 1999
3. This month calendar could be any month except September, April, June, November, or February. Why couldn't it be one of those months?
   Those months do not have 31 days each.
4. This is what the month of December 1999 will look like.
   - **a** The first of December 1999 will come on what day? Wednesday
   - **b** What is the date of the first Monday in December? 6th
   - **c** Christmas is on the twenty-fifth of December. What day will Christmas be on in 1999? Saturday
   - **d** What day will be the first day of 2000? Saturday
   - **e** How many Wednesdays in this December? 5
     How many Sundays? How many Saturdays? 4 4
   - **f** Could any month of any year have more than five Wednesdays or Sundays or Saturdays? No
     Why? You would need at least 36 days in such a month.
     A month with *more* than 5 of any one of the days would have more than 35 days ($5 \times 7 = 35$).

262

**Time Spent in School from 9:00 A.M. Through 3:00 P.M.**




# To think and talk about

Encourage discussion. Suggestions are given.

1. Do you think that you could get fooled about information presented in a graph? How?
   Discuss advertising, propaganda, misuse of statistics, lack of information.
2. Why are there so many different kinds of graphs?
   Some data are clearer on one type than on any other; some are more interesting
3. What kind of information have you found that is presented in graph form?
   All show comparative information.
4. Why are calendars found in just about every home, school, and business place?
   We plan ahead with calendars. Calendars serve as a standard unit of measure for time.

Keep your eyes open. Watch for graphs and charts. Read those you use carefully. Don't get fooled by them.

263

Take another look at the circle graph. Does it tell you—

1. How many hours are in the school day?
2. How much school time is spent on physical education?
3. How much time is spent on mathematics?
4. How much time is spent on art or music?
5. How much time is spent on reading and language arts?
6. How much time is spent on spelling?
7. How much time is spent on science?
8. How much more time is spent on social studies than on science?
9. How much time is spent having lunch?

**lesson** Pages 263, 264

**goal** Evaluating the usefulness of charts and graphs

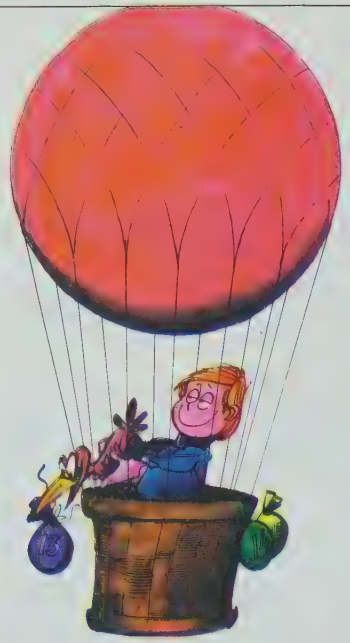
**page 263** Emphasize that to be useful, graphs and charts should show all information clearly labeled.

This page is for sharing ideas. It also will give you a chance to determine the depth of understanding your pupils have about graphs and charts.

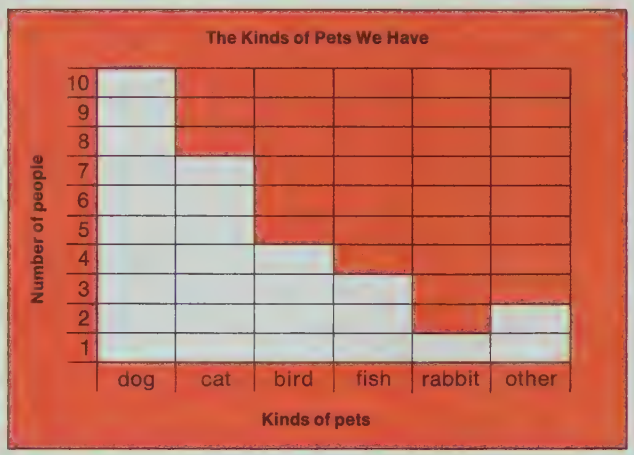
**goal** **Checkout**—reading a bar graph for specific information

**page 264** The questions should be answered independently, but you may want to read the questions aloud so that everyone can concentrate on the graphs and their answers.

Encourage the children to continue to watch for graphs. Some graphs used in advertising copy are both colorful and a challenge to interpret.



# CHECKOUT




Skill: Reading information shown on a graph

**1.** Look at the graph. Then answer these questions.

**a** Does the graph tell how many dogs in all? No

**b** Does the graph tell how many people have dogs? Yes—10

**c** Tell how many people have fish. 3

**d** Tell how many people have rabbits. 1

**e** Tell how many people have other kinds of pets. 2

**f** What do you think the other pets might be?
Answers will vary. Examples: hamsters, llamas, mice, snakes, turtles

Additional ideas for chart and graph experiences.

- Tally and graph:
  colors of the socks each person is wearing.
- number of children present each day for a week
- number of children eating lunch in school each day for a week

**things** magazines, newspapers

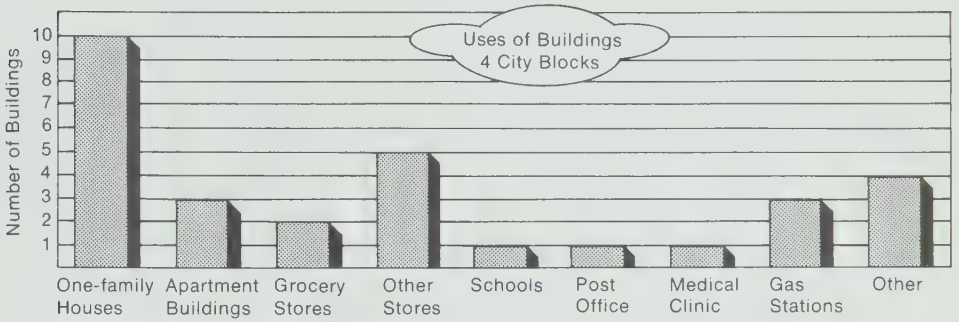
A job for researchers. Find samples of different kinds of graphs. In what section of the newspaper (magazine) were the most graphs found? What kinds of information do these graphs show?

# RESOURCES

## another form of evaluation

**for Checkout**—page 264

1. Look at the graph. Then answer the questions.
   a) Does the graph tell how many buildings are one-family houses? Yes
   b) Does the graph tell how many apartments there are? No
   c) Tell how many grocery stores there are. 2
   d) Tell how many other stores there are. 5
   e) How many gas stations are there? 3
   f) What do you think the other uses might be? Answers will vary. Examples: factories, office buildings, parking garages, police station




## additional learning aids

**concept**—chapter objectives 1, 2, 3

**SRA products**

*Mathematics Involvement Program*, SRA (1971)
Cards: 292, 223, 273, 363, 364

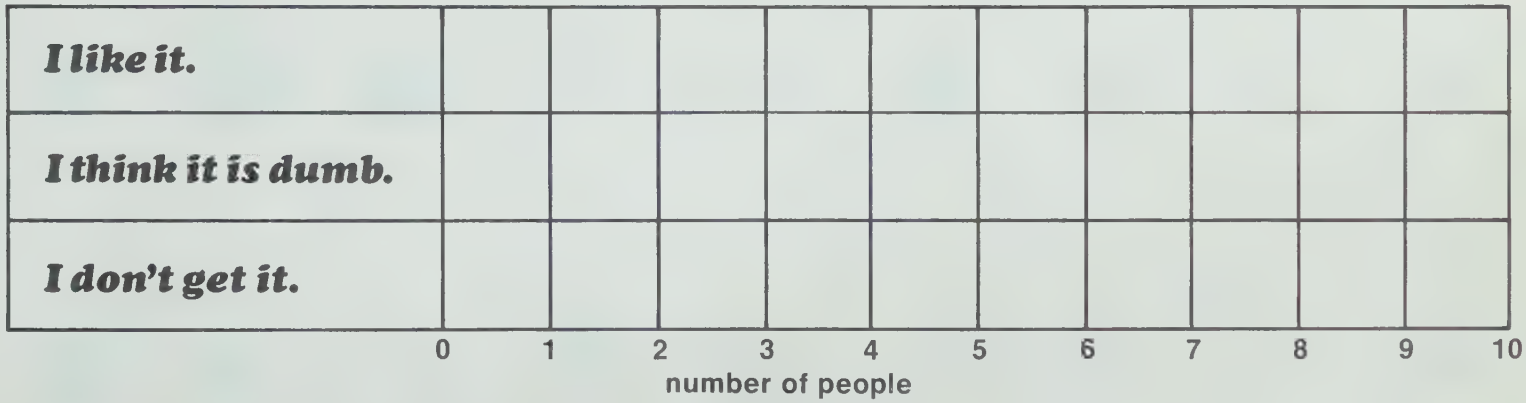
**other learning aids** (described on page 264g)—
Graph Gallery, Making and Using Graphs and Nomographs

 Permission to reproduce for school use.

Tell the same joke to ten people. Have them make a check on a card.

| | | | | |
|---|---|---|---|---|
| ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* |
| ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* | ☐ *I like it.*<br>☐ *I think it is dumb.*<br>☐ *I don't get it.* |

Make a graph.




Was it a good joke?

© 1974, SRA. Permission to reproduce for school use.

Use the cards. Make the longest sentence you can.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| 10 | 11 | 12 | 13 | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | = |
| + | + | − | − | × | × | ÷ | ÷ | 0 |



© 1974, SRA. Permission to reproduce for school use.

# Mul-tables

Two, three, or four people can play. You need the 94 tiles. Each person needs a table.

Put the tiles facedown. The first player picks a tile and puts it on his table. The tile gives a product; it must go on the right place in the table. "Free" tiles go anywhere. If the player makes a mistake, another player can take the tile and put it on his own table.

Then the next player has a turn, then the next, and so on. Pick one tile each turn.

The winner is the first person who gets five tiles in a row up-and-down, across, or diagonally.

This is the table for Mul-tables.

| × | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | |
| 2 | | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | | | | | | | | | |
| 5 | | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | | | | | | | | | |
| 9 | | | | | | | | | |

© 1974, SRA. Permission to reproduce for school use.

These are the tiles for Mul-tables. Cut them out.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 1 |
| 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 4 |
| 3 | 6 | 9 | 12 | 15 | 18 | 21 | 24 | 27 | 9 |
| 4 | 8 | 12 | 16 | 20 | 24 | 28 | 32 | 36 | 16 |
| 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 25 |
| 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 36 |
| 7 | 14 | 21 | 28 | 35 | 42 | 49 | 56 | 63 | 49 |
| 8 | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 | 64 |
| 9 | 18 | 27 | 36 | 45 | 54 | 63 | 72 | 81 | 81 |
| FREE | FREE | FREE | FREE | | | | | | |

© 1974, SRA. Permission to reproduce for school use.

# Other Learning Aids

## whole-number concepts

**Abacus board** (Creative Publications) Counting board useful for teaching place value
**Abacus Spinner Game** (Math Shop) Game for recognition and understanding of place value
**Chip Trading** (Scott Scientific) Several games that develop understanding of place value
**Flip-A-Strip Place Value Chart** (Developmental Learning Materials) Easel board chart to provide practice with place value and whole-number operations
**Place Value I and II** (Math Shop) Self-correcting cards to provide practice in reading of numbers through hundred millions

## whole-number operations

**Calculator** (Sigma Scientific) Four place-value calculator for addition and subtraction
**Checkermatics** (SEE) [level 1] A game for reinforcement and enrichment in whole-number skills
**Counting chips** (Creative Publications) Plastic disks of eight colors
**Cuisenaire Rods®** (Cuisenaire) Centimetre rods that provide a concrete approach to developing operations
**Dividing Machine** (DLM) Device to reinforce basic division facts
**Fact-O** (Math Shop) Activities for addition and subtraction facts
**I Win** (Scott, Foresman) [sets 1 and 2] Cards to provide practice in four basic operations
**Lots-A-Links** (Creative Publications) Plastic links that snap together for counting activities
**Mathematical Balance** (Mind/Matter) Plastic balance and weights to show relationships between addition and subtraction
**Mathfacts Games™** (Milton Bradley) [levels 3–5] Self-instructional and self-checking games that deal with the basic facts
**Multifax & Quotient** (Math Shop) Games in which number sentences are formed
**Multiplying Machine** (Math Shop) Self-checking machine used to practice the facts
**Orbiting the Earth** (Scott, Foresman) [addition and subtraction] Game with vinyl playing field for fact practice
**Quizmo** (Milton Bradley) Lotto-type game that reinforces basic skills with whole numbers
**Stamina** (Creative Publications) Spinner game providing practice with whole-number operations
**Tally and Difference** (Creative Publications) Games in which the addition and subtraction facts are used to form number sentences
**Unifix Mathematics Classroom Kit** (ETA) Set of interlocking cubes that develop understanding of the whole-number operations
**Veri-Tech Senior** (ETA) [addition, subtraction, and multiplication books] A self-checking device that provides practice with whole-number operations
**Winning Touch** (Ideal) A game for multiplication facts

## fractional-number concepts

**Action Fraction Games** (Constructive Playthings) Games to develop concepts and skill with fractions
**Fraction Bars Student Activity Book** (Creative Publications) Games and activities to teach specific objectives for fractions
**Fraction Dominoes** (SEE) Game involving matching a fractional numeral with its model
**Fraction Inlay Boards** (General Learning Corp.) Fractional parts of circles or squares
**Fraction Line Set** (Sigma Scientific) An activity to help visualize operations by computing with fraction strips

## geometry

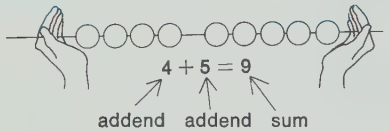
**Geoboard Activity Cards** (Creative Publications) [primary and intermediate sets] Geoboard activities that lead pupils to explore, compare, and make shapes
**Geoboard Kit** (Cuisenaire) Plastic geoboards and related activity cards that show basic geometric concepts
**Learn to Fold—Fold to Learn** (Lyons & Carnahan) Workbook that presents a variety of activities to demonstrate symmetry
**Metric Primary Shapes** (Invicta) Basic geometric shapes and work cards that reinforce identification skills
**Mira** (Creative Publications) An aid for investigating properties of plane geometry
**Mira Math for Elementary School** (Creative Publications) Series of activities to be used with the mira
**Paper and Pencil Geometry** (Lyons & Carnahan) A geometry book that provides activities to develop basic geometric concepts
**Pattern Blocks and Mirrors** (Math Shop) Colored blocks used to investigate geometric figures and mirror reflections
**Tangrams** (Creative Publications) A 7-piece puzzle to be used with tangram shapes
**Tangramath** (Creative Publications) Book to be used with tangram pieces for exploring concepts of shape, congruence, similarity, and area

## measurement

**Equal Pan Scales** (ESA) Pan balance designed to develop weighing techniques
**Judy Clock** (General Learning) Movable hands and visible functioning gears to provide learning experiences in telling time
**Learning about Measurement** (Lyons & Carnahan) A workbook for customary and metric measurement activities
**Linear Measures** (DLM) A series of linear measuring activities using the customary system
**Making and Using Graphs and Nomographs** (Lyons & Carnahan) A workbook that develops concepts and skill in the making and reading of graphs
**Metric Trundle Wheel** (Invicta) Wheel designed to introduce concepts of linear measurement
**100 g Balance** (ESA) A plastic balance for weighing masses of between 1 gram and 100 grams
**Tell-Time Quizmo** (Milton Bradley) A lotto-type game to stimulate interests in telling time

# GLOSSARY

**addition** Putting together

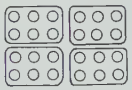



**array**

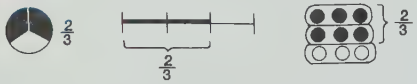
**digit** Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

**division**

$24 \div 6 = 4$ or $6\overline{)24}$ (4 / 24 / 24 (4 × 6) / 0)



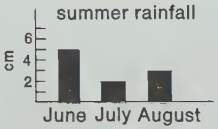
**fraction** A number that tells how much




$\frac{2}{3}$ ← numerator (how many parts shaded)
$\frac{2}{3}$ ← denominator (how many parts in all)

**graph** A way of picturing information

a bar graph:

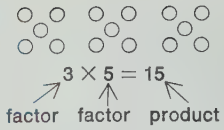



**line segment** A part of a line

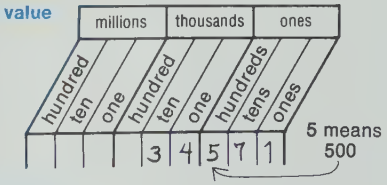
**math sentence**

addition: $3 + 4 = 7$
subtraction: $16 - 7 = 9$
missing factor: $3 \times \square = 12$
division: $12 \div 3 = 4$

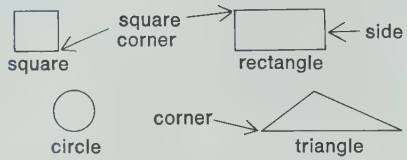
**multiplication**



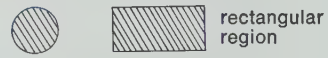

**place value**



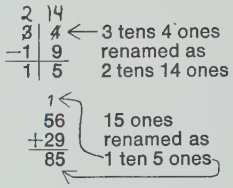

**plane figure**



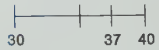

**region**




**renaming**

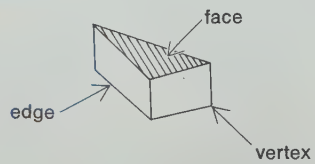



**rounding**



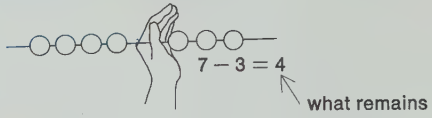

37 is closer to 40 than to 30. 37 rounds to 40.

**solid object**




**standard unit of measure** An agreed-upon length, weight, or capacity used to measure things. (See Tables of Measure.)

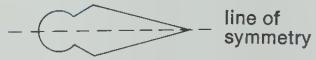
**subtraction** Taking away




**symbol**

| | | | |
|---|---|---|---|
| + | plus | > | is greater than |
| − | minus | < | is less than |
| × | times | = | equals |
| ÷ | divided by | ) ( | division problem |

**symmetry** Fold along the line. The two parts match.




**tally chart** A way to record a count

Games Won

| | |
|---|---|
| Joe | 𝍸 \| |
| Sam | 𝍸 \|\| |

tally marks

**whole number** Tells how many
0, 1, 2, 3, 4, 5, and the rest of the counting numbers
even numbers—0, 2, 4, 6, and so on
odd numbers—1, 3, 5, 7, and so on

# INDEX


**addition**
applications 7, 10–11, 13–14, 19, 34–35, 62, 64, 69–70, 159, 162–163, 175
facts 3–9, 14, 16, 60, 152–153, 287
hundreds, tens, and ones
renaming 66–71, 165–168, 174, 176, 288
short form (introduction) 67–69
sum (definition) 152
symbol 47
tens
no renaming 18–19
renaming 60, 155, 293
tens and ones
no renaming 20, 157
renaming 21–23, 33, 61–64, 71, 159–160, 163, 288, 294
short form (introduction) 61–63
three addends 10–12, 19, 70–71

**charts**
applications 245, 248, 259–262
making 246, 248
reading 246, 248, 259–261
tally chart 248

**division**
applications 218–219, 227, 230–231, 303–304
facts 222–229, 301–302, 305
hundreds, tens, and ones 306–307
related to multiplication 223–224, 227–228, 301–302, 305–308
symbols (introduction) 223–224, 228

**estimation** 292–296

**fractions**
addition 212–213
applications 203, 215
comparing 207, 210
denominator (definition) 200
number-line model 204–212, 214–215
numerator (definition) 200
region model 200–201, 208–209, 213
renaming 208–209, 211
set model 202–203
subtraction 214

**geometry**
applications 83, 111–112, 118
circle 81–82, 111–112, 114
corner 76–81
edge 75–76
face 75
line of symmetry 115–118
line segment 77
parallelogram 112, 115, 117
plane figures 78–82, 110–117
rectangles 79–81, 110–112, 114, 117
side 77–81
solid figures 75–77
square 79–80, 110–112, 114
square corners 81, 113, 114
surface 75
symmetry 115–118
triangle 80–81, 111–113, 115
vertex 76

**graphs**
applications 247, 249–258, 263
bar graph 245, 247, 249–251, 256
circle graph 254
line graph 254–256
pictograph 252–253, 258

**measurement**
addition 278
area (exploration) 82
capacity
applications 276, 284
gallon 275, 278
pint 275–277
quart 275–278
converting units 189, 193, 277, 281,
length
applications 181–182, 188–194, 274, 276–277, 283–284, 299
centimetre 181, 183–189, 191–192, 195, 277–281, 299–300
foot 181, 189–190, 192–194, 276–278, 281, 299–300
inch 181, 185–191, 193–194, 276–278, 281–282, 299–300
kilometre 192–193, 299
metre 181, 188–189, 191–193, 277–278, 299–300
metric 192
mile 181, 192–193, 259, 281, 283, 299
perimeter 279–280
standard unit 183, 185, 190
yard 181, 188–190, 192–194, 276–278, 281, 299–300
standard unit 284
time
A.M., P.M. 267–271
applications 268–272, 283–284
calendar 262
day, month, year 262, 267
hour, minute 258, 266–271
weight
applications 235–240, 242, 284, 298
gram, kilogram 234–236, 238, 241–242
ounce, pound 234–236, 238–242, 276–278,
weight scales 233, 239–240, 242

**money** 89, 120, 141, 272–273, 298

**multiplication**
applications 49–50, 120, 129, 141, 143, 298
arrays 43–46, 121–122, 127, 131–134, 137, 139, 220
factor 121–126
facts 48–50, 122–130, 220–221, 223, 301–302

missing factor 220–221, 223–2
number line 124
product 121–126
related to addition 38–39
related to division 223–224, 227–228, 301–302, 305–308
set model 41–42, 121, 123
symbol 47, 121, 224
tens and ones
no renaming 131–133
renaming 134–141, 296

**numbers**
even 287–290
odd 287–290
zero 128, 172, 204, 291

addition 18–23, 33, 61–69, 157, 159–160, 163, 165–169, 174, 176–177
arrays 54
comparing 59
division 228–229
hundreds and below 54–57
multiplication 131–140
renaming 57–58, 90, 98
subtraction 24–32, 87–88, 90–96, 98–105, 158, 161, 164, 170, 174, 176–177
ten-trays 17–18, 20–21, 24–29
thousands and below 56, 58
value of digits 147–151, 291

**skip-counting** 40, 125, 225–226

**subtraction**
applications 13–14, 32, 34–35, 89, 93, 96–97, 101, 107, 162, 175
checking with addition 16, 32, 171
difference (definition) 152
facts 13–16, 86, 88, 152, 154, 289
hundreds, tens, and ones
no renaming 91–92
renaming 98–106, 164, 170–171, 173–174, 176, 290, 295
symbol 47
tens
no renaming 24, 87, 295
renaming 156
tens and ones
no renaming 25–26, 88, 90, 158
renaming 27–33, 93–96, 161, 295

**ACKNOWLEDGEMENTS**

*Design and Production:*
Design Counsel, Inc.

*Photographs:*
Studio photography by Clara Aich and George L. Senty
**1:** Photo Researchers (Cooke). **37:** Magnum (Uzzle). **47:** Magnum (Malloch). **48:** Magnum. **83:** *l* Magnum (Arnold). **84:** Magnum (Hartmann). **97:** Monkmeyer (Shackman). **101:** Photo Researchers (Thomas). **106:** DPI (Zalon). **107:** Monkmeyer (Lanks). **109:** Photo Researchers (Angermayer). **119:** Magnum (Hartmann). **143:** Magnum (Capa). **118:** *l* Photo Researchers (Angermayer); *r* Magnum (Henriques). **145:** Black Star (Evenhon). **152:** Monkmeyer (Rogers). **163:** George L. Senty. **174:** Magnum (Lessing). **190:** Photo Researchers (Thomas). **193:** Magnum (Hartmann). **197:** Magnum (Hartmann). **199:** Magnum (Yenne). **201:** Monkmeyer (Forsyth). **217:** Monkmeyer (Fujihira). **220:** Photo Researchers (Cooke). **221:** Black Star (Ward). **233:** *tl* Monkmeyer (Forsyth); *bl* DPI (Corlett); *ml* Black Star (McCoy); *tm* Nancy Palmer Agency (Hinton); *bm* Monkmeyer (Anderson); *br* Monkmeyer (Rogers); *tr* Magnum (Harbutt). **237:** Rapho Guillumette (Johns). **238:** Suzanne Szasz. **256–57:** Monkmeyer (Forsyth). **259:** Black Star (Wilson). **283:** Magnum. **303:** Monkmeyer (Attaway).

*Product Photographs:*
**77:** Nabisco, Inc. **86, 88, 90, 93, 95:** The Coca-Cola Company, Dr. Pepper Company. **219:** Del Monte Corporation.

*Trademarks:*
**86, 88, 90, 93, 95:** Coca-Cola®, Coke®, Tab®, and Fresca® are registered trademarks of the Coca-Cola Company.

QA 107 S42 1974 LEV-3 TCH-GD-
BK-4
SCIENCE RESEARCH ASSOCIATES
SRA MATHEMATICS LEARNING
39185871 CURR
*000020890554*

# TABLE

## METRIC

| | |
|---|---|
| 10 millimetres (mm) | = 1 centimetre |
| 10 centimetres (cm) | = 1 decimetre |
| 10 decimetres (dm) | = 1 metre |
| 10 metres (m) | = 1 dekametre |
| 10 dekametres (dkm) | = 1 hectometre |
| 10 hectometres (hm) | = 1 kilometre (km) |

## AREA

| | |
|---|---|
| 144 square inches (sq. in.) | = 1 square foot |
| 9 square feet (sq. ft.) | = 1 square yard |
| 4840 square yards (sq. yd.) | = 1 acre |
| 640 acres | = 1 square mile |
| 1 square mile (sq. mi.) | = 1 section (of land) |
| 36 sections | = 1 township |

| | |
|---|---|
| 100 square millimetres (sq. mm) | = 1 square centimetre |
| 10,000 square centimetres (sq. cm) | = 1 square metre |
| 100 square metres (sq. m) | = 1 are |
| 100 square ares (a) | |
| 100 hectares (ha) | |

## WEIGHT

| | |
|---|---|
| 16 drams (dr.) | = 1 ounce |
| 16 ounces (oz.) | = 1 pound |
| 2000 pounds (lb.) | = 1 ton (tn.) |

| | |
|---|---|
| 10 milligrams (mg) | = |
| 10 centigrams (cg) | = |
| 10 decigrams (dg) | |
| 10 grams (g) | |
| 10 dekagrams (dkg) | |
| 10 hectograms (hg) | |
| 1000 kilograms (kg) | |

## VOLUME

| | |
|---|---|
| 1728 cubic inches (cu. in.) | = 1 cubic foot |
| 27 cubic feet (cu. ft.) | = 1 cubic yard (cu. yd.) |

| |
|---|
| 1000 cubic millimetre |
| 1000 cubic centimetr |
| 1000 cubic decimetre |

## CAPACITY

**Liquid**

| | |
|---|---|
| 2 cups (c.) | = 1 pint |
| 2 pints (pt.) | = 1 quart |
| 4 quarts (qt.) | = 1 gallon (gal.) |

**Dry**

| | |
|---|---|
| 2 pints (pt.) | = 1 quart |
| 8 quarts (qt.) | = 1 peck |
| 4 pecks (pk.) | = 1 bushel (bu.) |

**Liquid and Dry**

| |
|---|
| 10 millilitres (ml) = |
| 10 centilitres (cl) = |
| 10 decilitres (dl) = |
| 10 litres (l) = |
| 10 dekalitres (dkl) = |
| 10 hectolitres (hl) = |

QA
107
S42
1974
Lev. 3
Tch. Gd.
Bk. 4

CURRICULUM
EDUCATION LIBRARY
UNIVERSITY OF ALBERTA

2468869

B16753

M. Vere DeVault
Helen Frehmeyer
Herbert J. Greenberg
Stanley J. Bezuszka

Reorder No. 3-043194
ISBN 0-574-43194-2